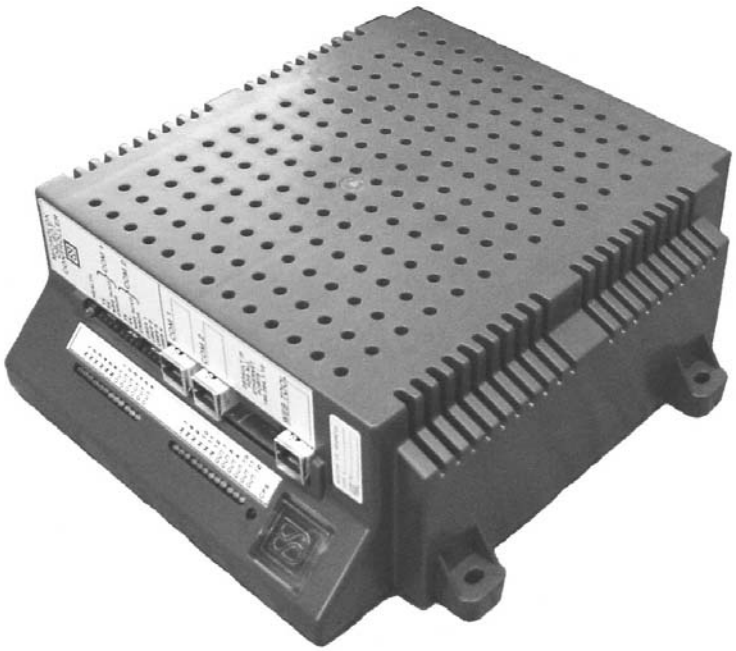
MICROLOK®

Object Controller

ASTS USA Part No.
N177001-xx



- Installation
- Operation

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This Class A digital apparatus complies with Canadian ICES-003.

CET appareil numerique de la classe A est conforme a la norme NMB-003 du Canada.

Revision History

REV.	DATE	NATURE OF REVISION
Original	November 2006	Initial Issue of Manual
1	January 2007	Incorporate ECO 140185-20 which corrected the connections in Figure 2-15 and 2-17. Minor editorial changes.
2	October 2007	Added Section 13 on the LED6 PCB. Added information for the HMAC option for the niacfg.ini file. Incorporated ECO 140228-7 which added the Sections 4.4.2.1 – Clear Link Statistics, 4.4.3.1 – Variable/Bit Filtering, and 4.4.4 – Serial Message Monitor. Minor editorial changes.
3	November 2007	Corrected Figure 2-20; figure was wrong.
4	June 2008	Incorporate ECO 140309-1 which updates Object Controller compiler and network diagnostic tool. Sections 2.2.3 -2.2.6, 8 and 9 were updated. Section 13, LED6 Signal Driver Board was removed.
4.a	August 29, 2008	Revised Section 3, 4, and 5 - for text and graphics.
4.b	September 5, 2008	Revisions per FTR comments.
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6	May 2009	Revised Section 5.8.1, Figure 9-1, Figure 9-4, and Section 15.2.5.1. Added Section 13.4 and Section 14.3.
7	February 2011	Revised for part number N17700119: Section 1.5.1, Table 3-1, Table 3-9, Figure 3-14, Section 10.6.3, Section 11.9, and Table 17-1.

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1. INTRODUCTION

1.1. Overview

TheASTS USA MICROLOK® Object Controller (OC) (Figure 1-1 and Figure 1-2) is a low cost, compact, programmable microprocessor device used for vital or non-vital control and indication of wayside devices such as switches, signals, or other equipment. It is a vital remote I/O device with programmable capabilities based on the ASTS USA MICROLOK II technology. The OC is packaged in a small footprint without losing its environmental integrity. The processor requirements mimic the vital MICROLOK II processing platform including the common ASTS USA MICROLOK II protocols.

The OC interfaces to the signal system via I/O wiring, a WebTool port (for diagnostics), and two COM ports.

1.2. Safety

Read and thoroughly understand this manual before attempting any of the procedures listed herein.
Pay particular attention to:

CAUTION

and

WARNING

These headings appear throughout this manual. Caution statements indicate conditions that could cause damage to equipment. Warning statements indicate conditions that could cause personal physical harm, serious injury, or loss of life. Always observe standard precautions familiar to trained electrical technicians when working on this equipment. Always adhere to all safety regulations stipulated by the railroad.

1.3. Acronyms

- GPS Global Positioning System
- HMAC Hash-keyed Message Authentication Code
- IE Internet Explorer (Microsoft)
- OC Object Controller
- TCP Transmission Control Protocol
- UDP User Datagram Protocol

MICROLOK ® is a registered trademark of Ansaldo STS USA, Inc.

1.4. System Components

The OC is shipped totally assembled and is ready to install directly from the factory. Inside the shipping container you will find:

1. The MICROLOK Object Controller
2. WAGO Connectors for inputs/outputs and power
3. CD containing MICROLOK Object Controller Manual SM-9494, and associated software (See Section 5.1).

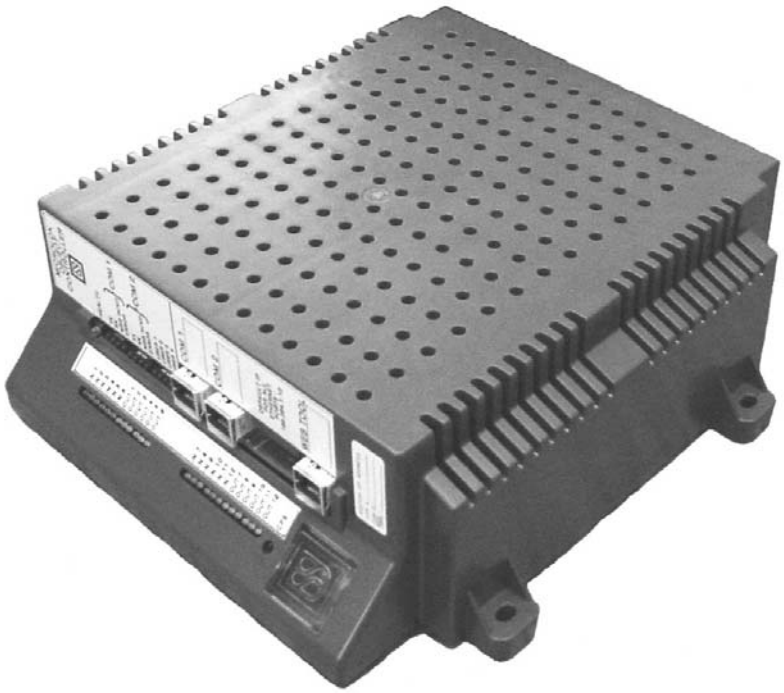


Figure 1-1. MICROLOK Object Controller

Rear **Front**

Figure 1-2. The Front and Rear of the MICROLOK Object Controller

1.5. Identifying the OC

Because of the various I/O options available with the OC, ensure that the unit is the proper one for the specific installation before attempting to install the OC. Check the part number and verify that it is the proper OC for the location (Refer to Section 3).

1.5.1. Object Controller Part Number N17700119

Object controller Part number N17700119 has a dongle that connects to the serial port on the front panel. The dongle consists of a DB-9 connector, EEPROM, and a length of wire (Refer to Figure 1-3). The length of wire is not connected electrically and is used to secure the dongle to a mounting surface. The EEPROM contains verification data for the application and configuration for the object controller. The DB-9 connector connects to the serial port or a write-enable adapter.

The EEPROM on the dongle verifies that the maintainer has properly replaced and checked the object controller configuration before installation. The dongle remains at the location and is connected to the replacement object controller.

To use the software in this manner, the CONFIGURE.ERROR system bit should be used to inhibit the CPS until the new configuration is confirmed (See Section 10.6.3 and Section 11.9). For example: ASSIGN ~CONFIGURE.ERROR TO CPS.ENABLE;

The dongle can only be programmed (via the diagnostic port) if a write-enable adapter is connected between the dongle and the serial port. See Section 11 for programing information. You must change an adjustable prarmeter and then change it back in order for the tool to resave the configuration.

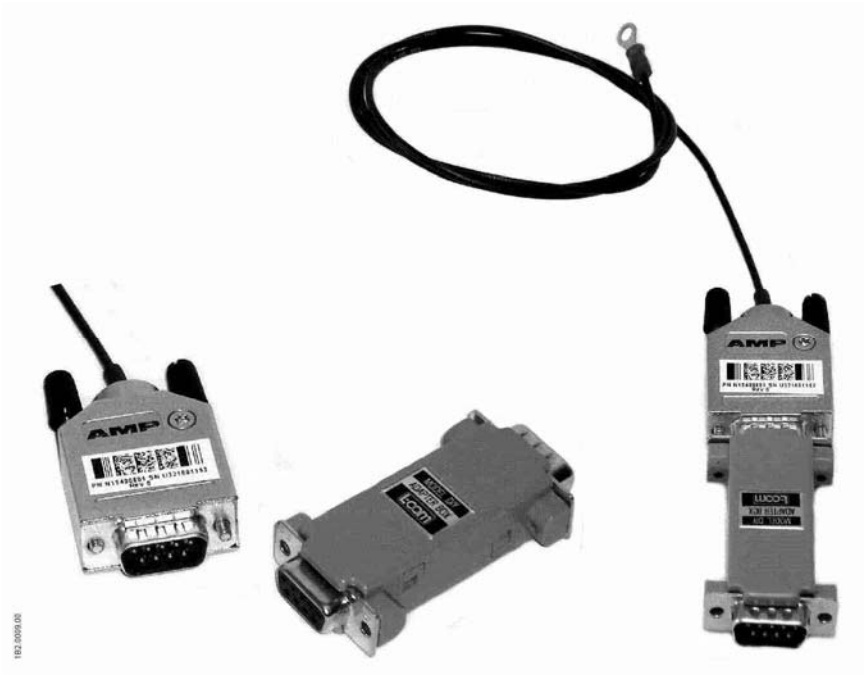


Figure 1-3. Dongle and Write-Enable Adapter

1.6. Installation Requirements

1.6.1. Tools Needed

A 4/32 inch or 3.5mm flat blade screw driver is used to insert wiring into the WAGO connectors. A special tool for this (insertion tool WAGO No. 210-120; ASTS USA No. J039000-0159) is also available if desired. The unit itself is mounted to the wall or shelf using standard bolts or screws.

1.6.2. Site Preparation

The OC is normally installed in the wayside house. The site should already have been prepared for the OC. The wiring and connectors should already be in and the mounting area should provide ample area to accept the OC. The overall dimensions and the mounting footprint for the OC are shown in Figure 1-4.

1.6.3. Mounting

The OC can be either shelf mounted or wall mounted. It is mounted the same in either orientation. (Refer to Figure 1-4).

Connecting the MICROLOK Object Controller to the System

To connect the OC to the system, connect a 12VDC source capable of providing at least 2.0 amps (Refer to Section 3.1.2.) to the input power connector (supplied) and plug it into the input power receptacle on the rear of the OC (Figure 1-5).

WARNING

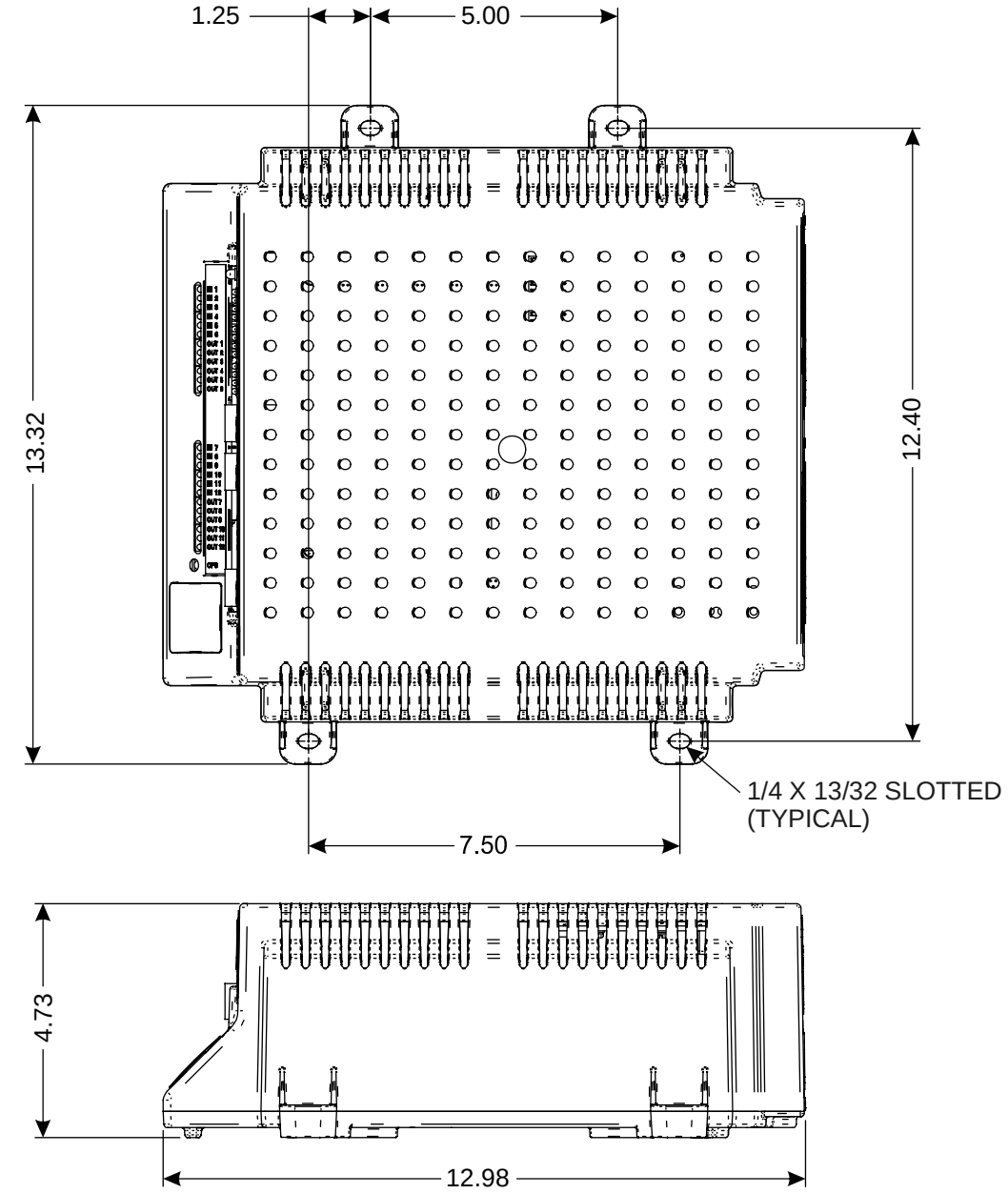
If the OC cannot be identified from either its label or from the figures in this manual that show the various configurations of the OC, do not use the unit.

Insert the connectors to the orange and gray terminal boards in the proper input and output arrangement.

CAUTION

Orange and gray connectors are keyed. Check the keying before inserting into the unit. Do not use excessive force to mate the connectors. If too much force is applied the keys could be damaged.

With the terminal connectors secure and the power cord installed, move the power switch to the ON position. The USS logo [Power LED (blue)] on the sloping panel on the front of the OC should illuminate (Figure 1-6).



NOTE:
ALL DIMENSIONS ARE IN INCHES.

Figure 1-4. The Dimensions of the MICROLOK Object Controller

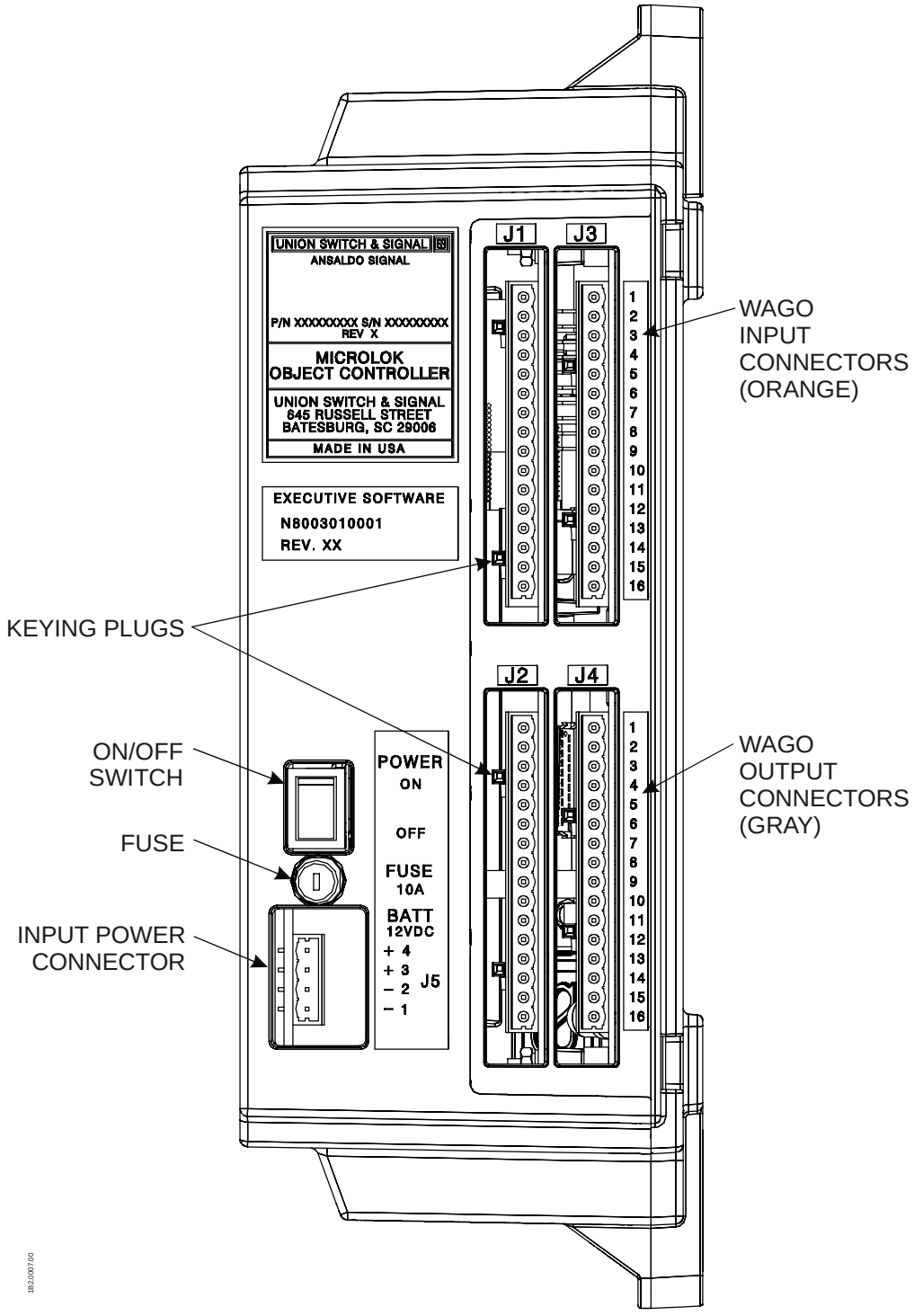


Figure 1-5. The Rear of the MICROLOK Object Controller

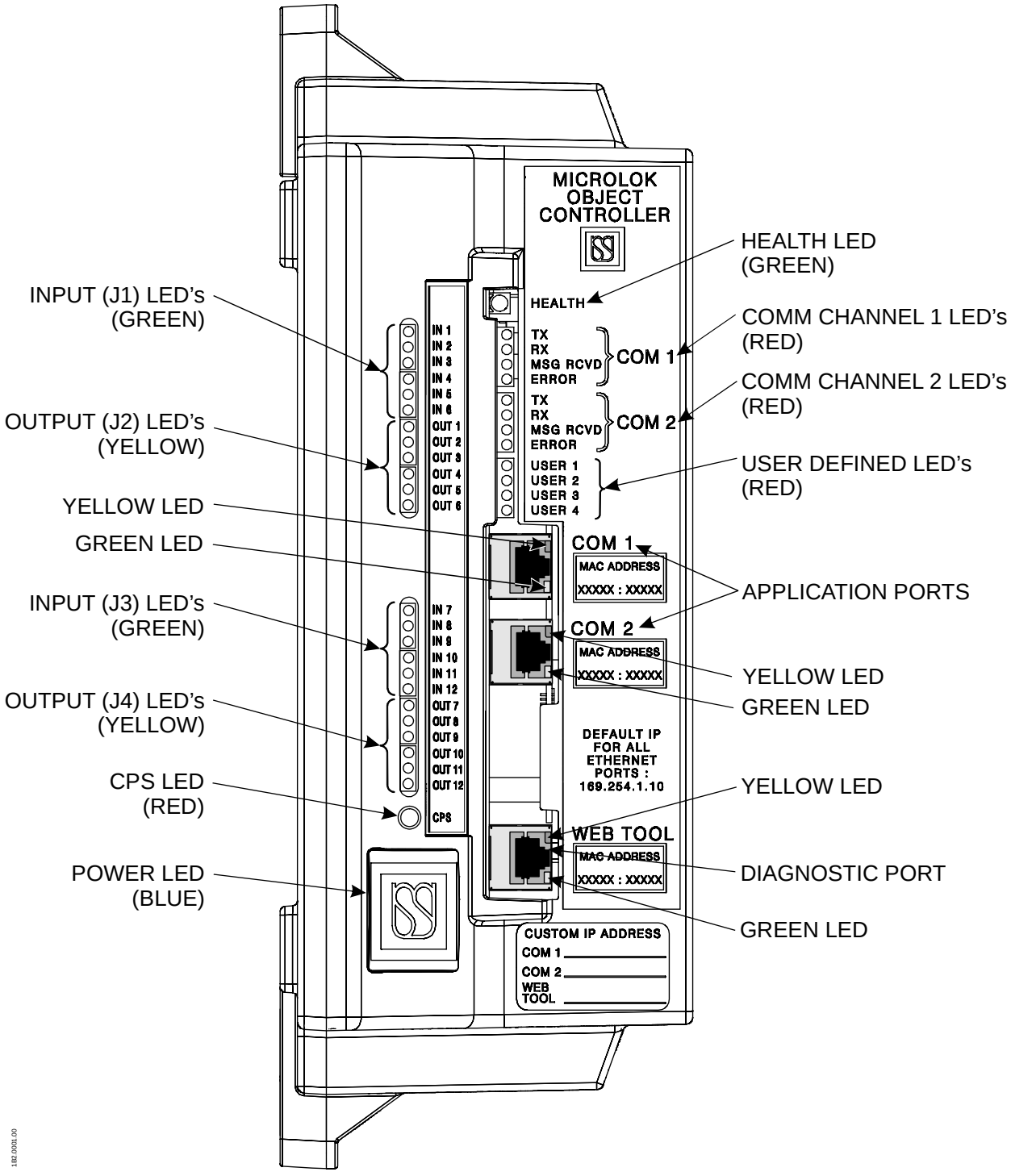


Figure 1-6. The Front of the MICROLOK Object Controller

2. DESCRIPTION

The main features of the OC are:

- The OC offers the flexibility of combining bi-polar and discrete inputs/outputs into a variety of configurations.
- The OC includes a unit health LED (green) indicator on the SCC PCB which gives a clear and visible indication of the unit's status.
- The OC is totally self-contained and is a line replaceable unit (LRU). This allows for quick, easy replacement in the field. All the components of the OC are contained within a ruggedized standard package.
- The entire OC, including all communication ports, is electrically isolated from the battery to 2000 volts.
- The OC has up to two (2) TCP/IP application ports (COM 1 and COM 2) for vital and non-vital MICROLOK II PEER protocol communication.
- The OC has a TCP/IP diagnostic port (WEB TOOL) for maintenance communication.
- The OC's optional serial RS-232 DB9 port is fully compatible with all MICROLOK II protocols.

The OC offers the following benefits to the user:

- Because of its compact design the OC fits into the typical 16" x 16" x 8" wayside junction box. This flexibility allows the user to eliminate a relay house or full size case thus reducing application costs.
- The OC, which is TCP/IP compatible, will connect to a local IP network; it utilizes a fully integrated TCP/IP stack, and is compatible with commercial off-the-shelf communication products.
- The OC uses web based tools which enable a maintainer to monitor and/or troubleshoot the unit with only a computer and a standard web browser.
- The status of the OC is shown via LEDs on the front panel of the case.

The OC is available in a variety of configurations (Table 3-1) based on its specific application.

3. OC CONFIGURATIONS

Table 3-1. MICROLOK Object Controller Part Numbers and Configurations

MODEL NUMBER	PART NUMBER	I/O CONFIGURATION	COMMUNICATION CONFIGURATION	WAGO CONNECTOR
OC 1001 (Figure 3-1)	N17700101	Mix I/O 4 Vital Inputs 4 Vital Outputs 2 Vital Proximity Sensors 1 Analog Input	Port 1 TCP/IP RJ-45 Port 2 Serial RS-232 DB9	J1, J2
OC 1002 (Figure 3-2)	N17700102	Mix I/O 4 Vital Inputs 4 Vital Outputs 2 Vital Proximity Sensors 1 Analog Input	Port 1 TCP/IP RJ-45 Port 2 TCP/IP RJ-45	J1, J2
OC 1003 (Figure 3-3)	N17700103	Mix I/O 8 Vital Inputs 8 Vital Outputs 4 Vital Proximity Sensors 2 Analog Input	Port 1 TCP/IP RJ-45 Port 2 Serial RS-232 DB9	J1, J2, J3, J4
OC 2001 (Figure 3-4)	N17700105	6 Vital Inputs 6 Vital Outputs	Port 1 TCP/IP RJ-45 Port 2 Serial RS-232 DB9	J1, J2
OC 2002 (Figure 3-5)	N17700106	6 Vital Inputs 6 Vital Outputs	Port 1 TCP/IP RJ-45 Port 2 TCP/IP RJ-45	J1, J2
OC 2003 (Figure 3-6)	N17700107	12 Vital Inputs 12 Vital Outputs	Port 1 TCP/IP RJ-45 Port 2 Serial RS-232 DB9	J1, J2, J3, J4
OC 2004 (Figure 3-7)	N17700108	12 Vital Inputs 12 Vital Outputs	Port 1 TCP/IP RJ-45 Port 2 TCP/IP RJ-45	J1, J2, J3, J4
OC 3001 (Figure 3-8)	N17700111	6 Vital Inputs	Port 1 TCP/IP RJ-45 Port 2 Serial RS-232 DB9	J1
OC 3002 (Figure 3-9)	N17700112	6 Vital Inputs	Port 1 TCP/IP RJ-45 Port 2 TCP/IP RJ-45	J1
OC-4001 (Figure 3-10)	N17700115	6 LED Signal Drivers 1 Non-Vital Input 1 Non-Vital Output	Port 1 TCP/IP RJ-45 Port 2 Serial RS-232 DB9	J1, J2
OC 4002 (Figure 3-11)	N17700116	6 LED Signal Drivers 1 Non-Vital Input 1 Non-Vital Output	Port 1 TCP/IP RJ-45 Port 2 TCP/IP RJ-45	J1, J2
OC 4003 (Figure 3-12)	N17700117	6 LED Signal Drivers 1 Non-Vital Input 1 Non-Vital Output 6 Vital Inputs 6 Vital Outputs	Port 1 TCP/IP RJ-45 Port 2 Serial RS-232 DB9	J1, J2, J3, J4
OC 4004 (Figure 3-13)	N17700118	6 LED Signal Drivers 1 Non-Vital Input 1 Non-Vital Output 6 Vital Inputs 6 Vital Outputs	Port 1 TCP/IP RJ-45 Port 2 TCP/IP RJ-45	J1, J2, J3, J4
OC (Figure 3-14)	N17700119	12 Vital Inputs 12 Vital Outputs	Port 1 TCP/IP RJ-45 Port 2 TCP/IP RJ-45	J1, J2, J3, J4

Table 3-2. Front Panel LED Operation

(Part numbers N17700101, Figure 3-1, and N17700102 Figure 3-2)

LED DESIGNATION	LED COLOR	FUNCTION
HEALTH	Green	Indicates the OC's health; this LED flashes at a rate of once per second when the unit is operating properly.
COM 1 TX	Red	Flashes to indicate that data are being transmitted.
COM 1 RX	Red	Flashes to indicate that good data are being received.
COM 1 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 1 ERROR	Red	Indicates that there is an error with the received data.
COM 2 TX	Red	Flashes to indicate that data are being transmitted.
COM 2 RX	Red	Flashes to indicate that good data are being received.
COM 2 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 2 ERROR	Red	Indicates that there is an error with the received data.
USER 1 USER 2 USER 3 USER 4	Red	User defined in the application software.
Ethernet Port LEDs	Yellow	Indicates correct wiring between this port and a hub. The LED is ON when the wiring is good.
Ethernet Port LEDs	Green	Turns ON at power up and turns OFF after approximately 1 minute when it resets.
IN 1 IN 2 IN 3 IN 4	Green	Indicates that Vital Inputs No. 1 through No. 4 are energized. Power connection is at the upper board orange connector J1 on the rear of the unit.
SPARE	NA	Not used in this application.
AN 1	Green	Turns ON when the analog voltage is within the range specified by the application program. This connection is at the upper board orange connector J1 on the rear of the unit.
OUT 1 OUT 2 OUT 3 OUT 4	Yellow	Indicates that Vital Outputs No. 1 through No. 4 are energized. Power connection is at the upper board gray connector J2 on the rear of the unit.
PRX 1 PRX 2	Yellow	When On steady, indicates that the sensor is detecting metal. When flashing, indicates that the sensor is in an indeterminate state, or there is a fault condition such as a bad sensor, an open wire, a short, a sensor that is wired backward, or an unconnected sensor. When Off, indicates that the sensor in not detecting metal. This connection is at the upper board orange connector J1 on the rear of the unit.
CPS	Red	Indicates that the Conditional Power Supply is operational, supplying power to the vital outputs.
US&S Logo	Blue	This is the power indicator and is ON when power is applied to the unit.

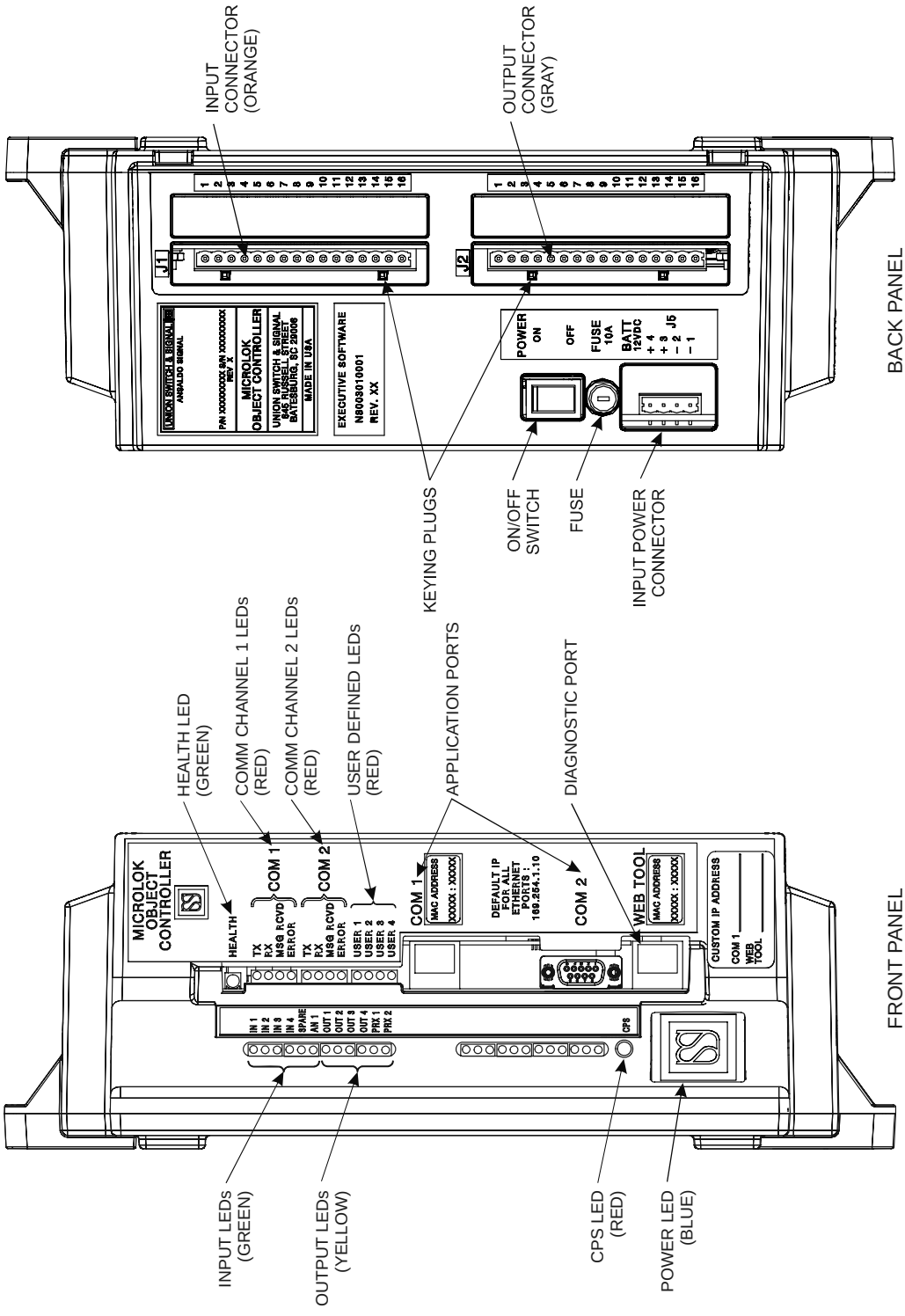


Figure 3-1. Object Controller N17700101 Front and Rear Panels

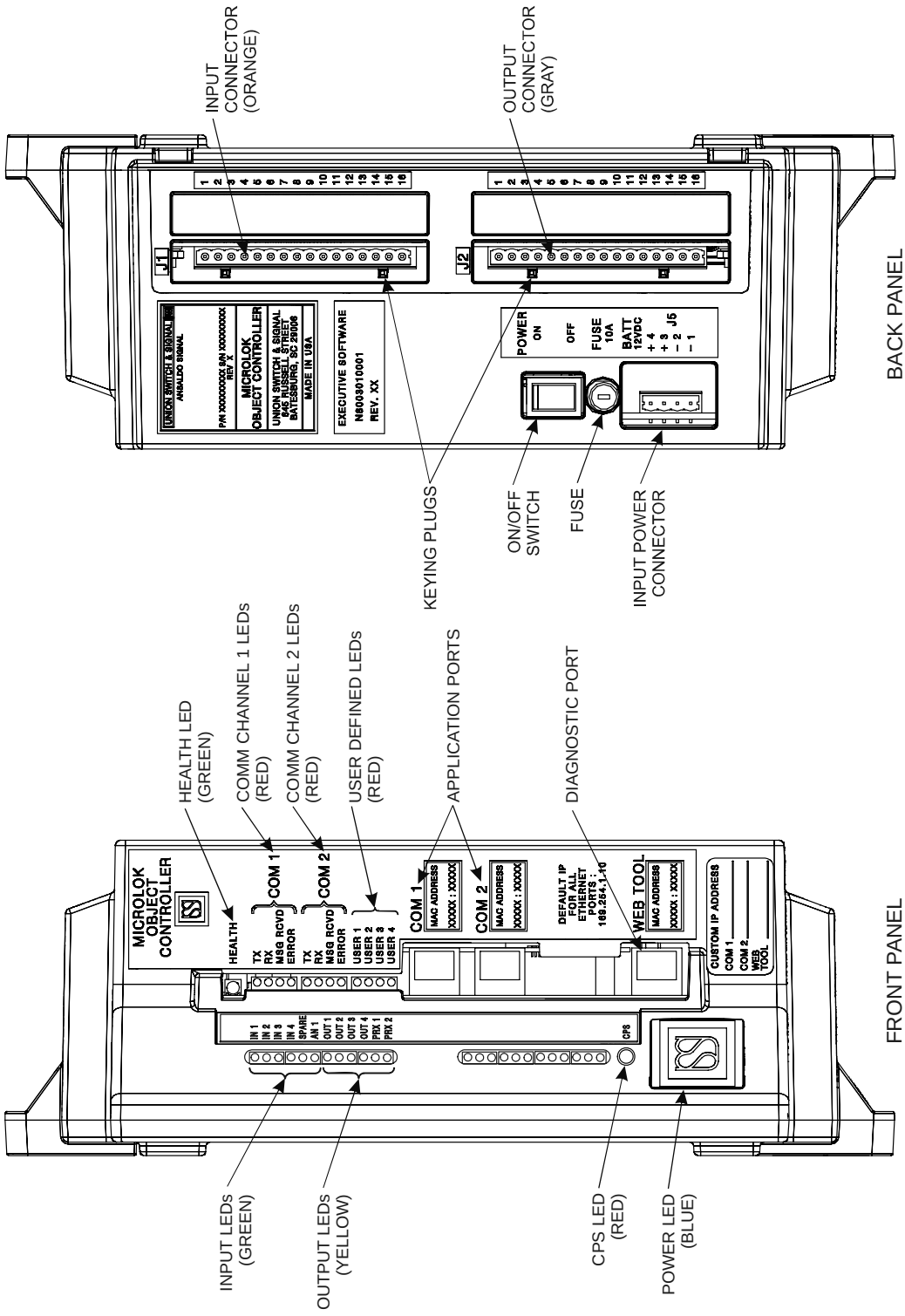


Figure 3-2. Object Controller N17700102 Front and Rear Panels

Table 3-3. Front Panel LED Operation

(Part Number N17700103 Figure 3-3)

LED DESIGNATION	LED COLOR	FUNCTION
HEALTH	Green	Indicates the OC's health; this LED flashes at a rate of once per second when the unit is operating properly.
COM 1 TX	Red	Flashes to indicate that data are being transmitted.
COM 1 RX	Red	Flashes to indicate that good data are being received.
COM 1 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 1 ERROR	Red	Indicates that there is an error with the received data.
COM 2 TX	Red	Flashes to indicate that data are being transmitted.
COM 2 RX	Red	Flashes to indicate that good data are being received.
COM 2 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 2 ERROR	Red	Indicates that there is an error with the received data.
USER 1 USER 2 USER 3 USER 4	Red	User defined in the application software.
Ethernet Port LEDs	Yellow	Indicates correct wiring between this port and a hub. The LED is ON when the wiring is good.
Ethernet Port LEDs	Green	Turns ON at power up and turns OFF after approximately 1 minute when it resets.
IN 1 IN 2 IN 3 IN 4	Green	Indicates that Vital Inputs No. 1 through No. 4 are energized. Power connection is at the upper board orange connector J1 on the rear of the unit.
SPARE	NA	Not used in this application.
AN 1	Green	Turns ON when the analog voltage is within the range specified by the application program. This connection is at the upper board orange connector J1 on the rear of the unit.
OUT 1 OUT 2 OUT 3 OUT 4	Yellow	Indicates that Vital Outputs No. 1 through No. 4 are energized. Power connection is at the upper board gray connector J2 on the rear of the unit.
PRX 1 PRX 2	Yellow	When On steady, indicates that the sensor is detecting metal. When flashing, indicates that the sensor is in an indeterminate state, or there is a fault condition such as a bad sensor, an open wire, a short, a sensor that is wired backward, or an unconnected sensor. When Off, indicates that the sensor in not detecting metal. This connection is at the upper board orange connector J1 on the rear of the unit.
IN 5 IN 6 IN 7 IN 8	Green	Indicates that Vital Inputs No. 5 through No. 8 are energized. Power connection is at the lower board orange connector J3 on the rear of the unit.
SPARE	NA	Not used in this application.
AN 2	Green	Turns ON when the analog voltage is within the range specified by the application program. This connection is at the lower board orange connector J3 on the rear of the unit.
OUT 5 OUT 6 OUT 7 OUT 8	Yellow	Indicates that Vital Outputs No. 5 through No. 8 are energized. Power connection is at the lower board gray connector J4 on the rear of the unit.

LED DESIGNATION	LED COLOR	FUNCTION
PRX 3 PRX 4	Yellow	When On steady, indicates that the sensor is detecting metal. When flashing, indicates that the sensor is in an indeterminate state. When Off, indicates that the sensor in not detecting metal. This connection is at the lower board orange connector J3 on the rear of the unit.
CPS	Red	Indicates that the Conditional Power Supply is operational, supplying power to the vital outputs.
US&S Logo	Blue	This is the power indicator and is ON when power is applied to the unit.

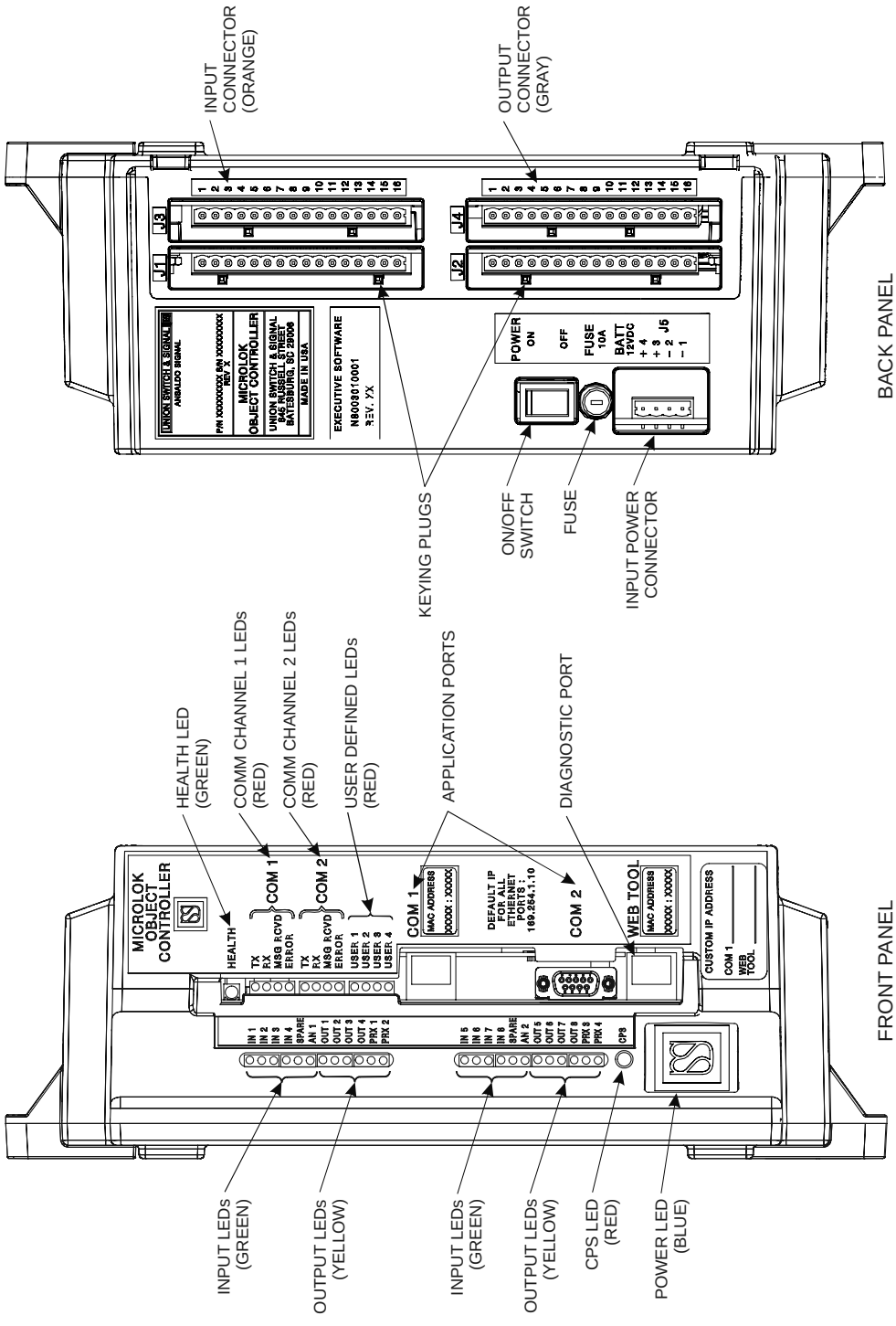


Figure 3-3. Object Controller N17700103 Front and Rear Panels

Table 3-4. Front Panel LED Operation

(Part numbers N17700105, Figure 3-4, and N17700106, Figure 3-5)

LED DESIGNATOR	LED COLOR	FUNCTION
HEALTH	Green	Indicates the OC's health; this LED flashes at a rate of once per second when the unit is operating properly.
COM 1 TX	Red	Flashes to indicate that data are being transmitted.
COM 1 RX	Red	Flashes to indicate that good data are being received.
COM 1 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 1 ERROR	Red	Indicates that there is an error with the received data.
COM 2 TX	Red	Flashes to indicate that data are being transmitted.
COM 2 RX	Red	Flashes to indicate that good data are being received.
COM 2 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 2 ERROR	Red	Indicates that there is an error with the received data.
USER 1 USER 2 USER 3 USER 4	Red	User defined in the application software.
Ethernet Port LEDs	Yellow	Indicates correct wiring between this port and a hub. The LED is ON when the wiring is good.
Ethernet Port LEDs	Green	Turns ON at power up and turns OFF after approximately 1 minute when it resets.
IN 1 IN 2 IN 3 IN 4 IN 5 IN 6	Green	Indicates that Vital Inputs No. 1 through No. 6 are energized. Power connection is at the upper board orange connector J1 on the rear of the unit.
OUT 1 OUT 2 OUT 3 OUT 4 OUT 5 OUT 6	Yellow	Indicates that Vital Outputs No. 1 through No. 6 are energized. Power connection is at the upper board gray connector J2 on the rear of the unit.
CPS	Red	Indicates that the Conditional Power Supply is operational, supplying power to the vital outputs.
US&S Logo	Blue	This is the power indicator and is ON when power is applied to the unit.

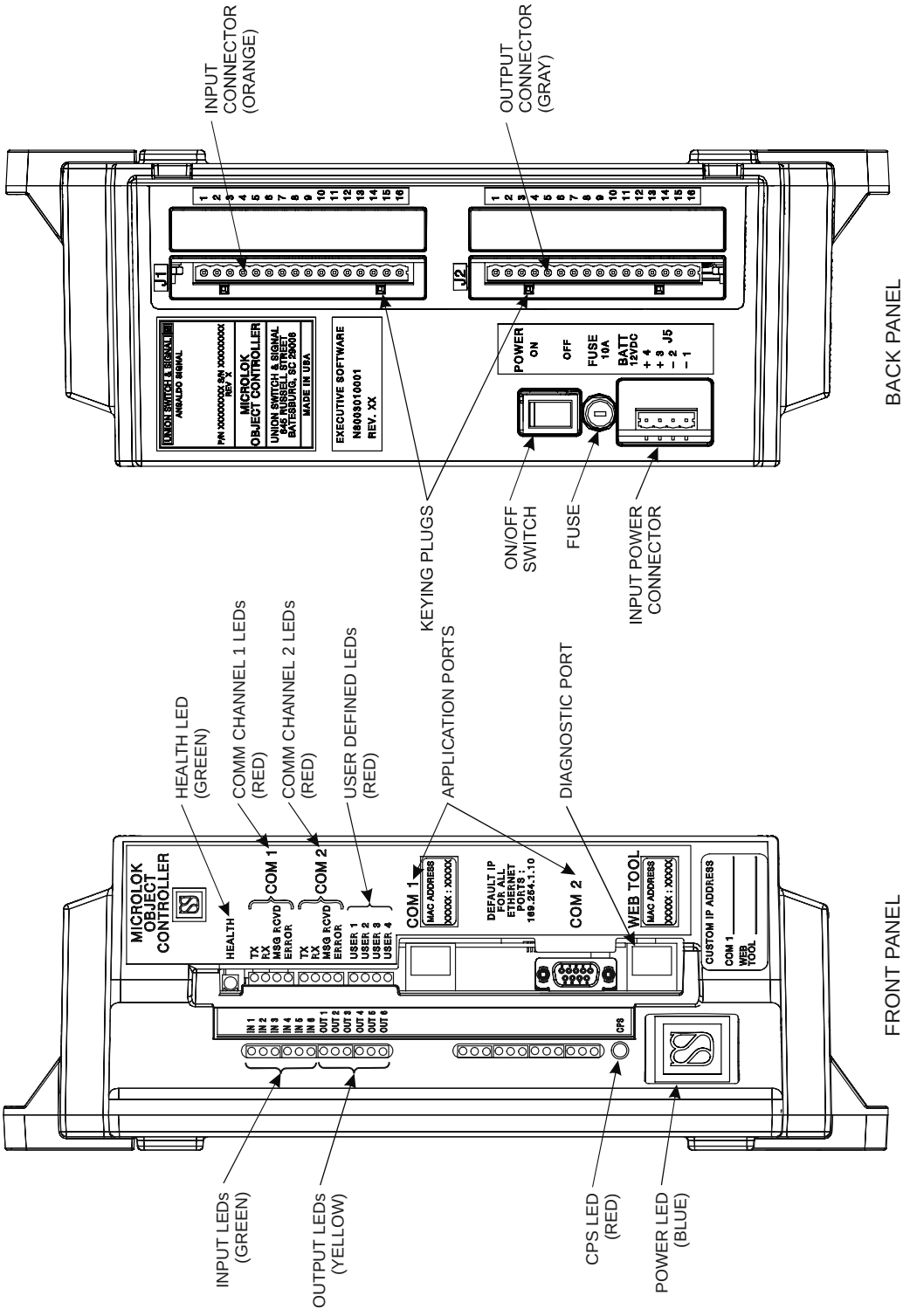


Figure 3-4. Object Controller N17700105 Front and Rear Panels

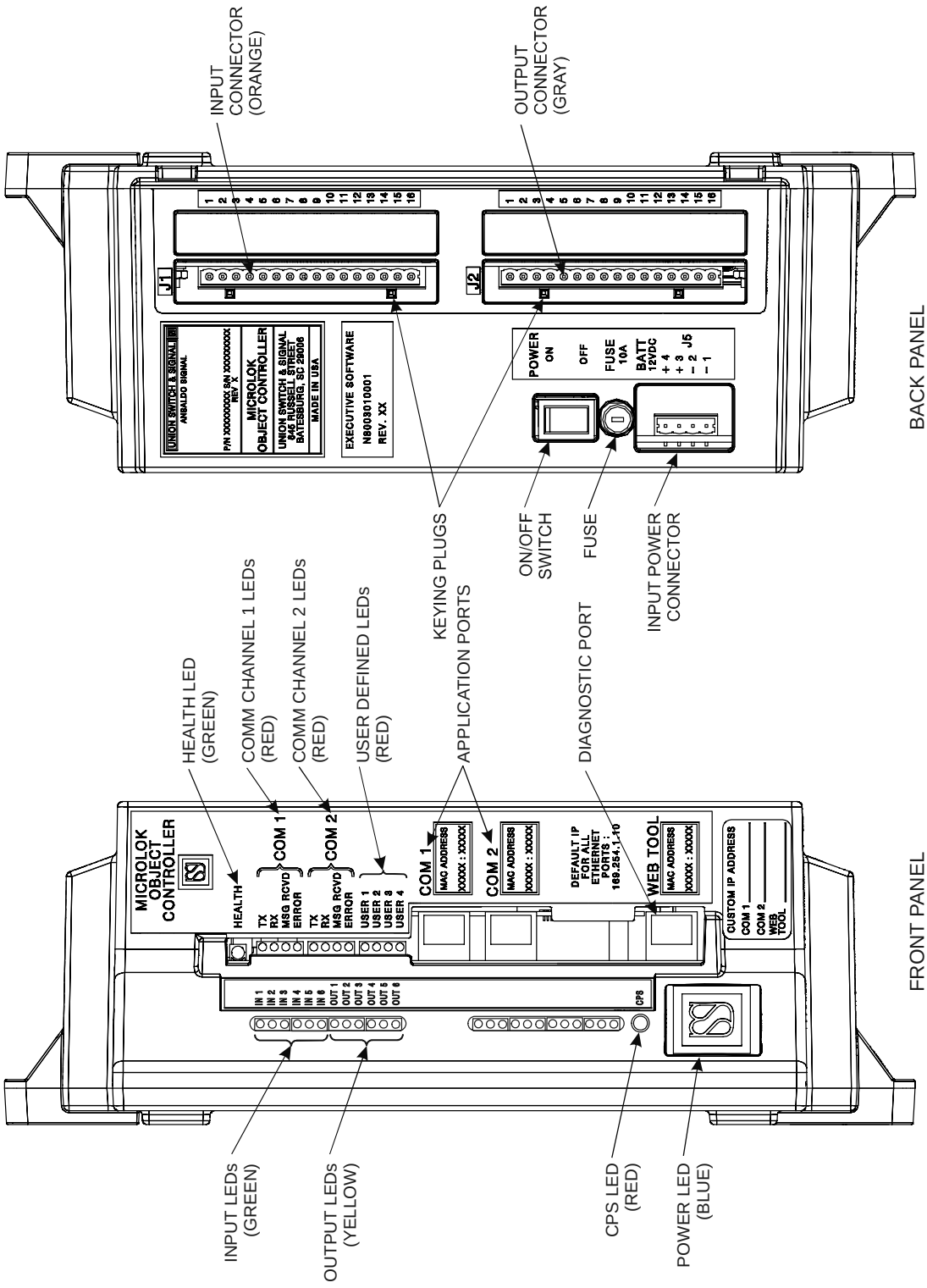


Figure 3-5. Object Controller N17700106 Front and Rear Panels

Table 3-5. Front Panel LED Operation

(Part numbers N17700107, Figure 3-6, and N17700108, Figure 3-7)

LED DESIGNATION	LED COLOR	FUNCTION
HEALTH	Green	Indicates the OC's health; this LED flashes at a rate of once per second when the unit is operating properly.
COM 1 TX	Red	Flashes to indicate that data are being transmitted.
COM 1 RX	Red	Flashes to indicate that good data are being received.
COM 1 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 1 ERROR	Red	Indicates that there is an error with the received data.
COM 2 TX	Red	Flashes to indicate that data are being transmitted.
COM 2 RX	Red	Flashes to indicate that good data are being received.
COM 2 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 2 ERROR	Red	Indicates that there is an error with the received data.
USER 1 USER 2 USER 3 USER 4	Red	User defined in the application software.
Ethernet Port LEDs	Yellow	Indicates correct wiring between this port and a hub. The LED is ON when the wiring is good.
Ethernet Port LEDs	Green	Turns ON at power up and turns OFF after approximately 1 minute when it resets.
IN 1 IN 2 IN 3 IN 4 IN 5 IN 6	Green	Indicates that Vital Inputs No. 1 through No. 6 are energized. Power connection is at the upper board orange connector J1 on the rear of the unit.
OUT 1 OUT 2 OUT 3 OUT 4 OUT 5 OUT 6	Yellow	Indicates that Vital Outputs No. 1 through No. 6 are energized. Power connection is at the upper board gray connector J2 on the rear of the unit.
IN 7 IN 8 IN 9 IN 10 IN 11 IN 12	Green	Indicates that Vital Inputs No. 7 through No. 12 are energized. Power connection is at the lower board orange connector J3 on the rear of the unit.
OUT 7 OUT 8 OUT 9 OUT 10 OUT 11 OUT 12	Yellow	Indicates that Vital Outputs No. 7 through No. 12 are energized. Power connection is at the lower board gray connector J4 on the rear of the unit.
CPS	Red	Indicates that the Conditional Power Supply is operational, supplying power to the vital outputs.
US&S Logo	Blue	This is the power indicator and is ON when power is applied to the unit.

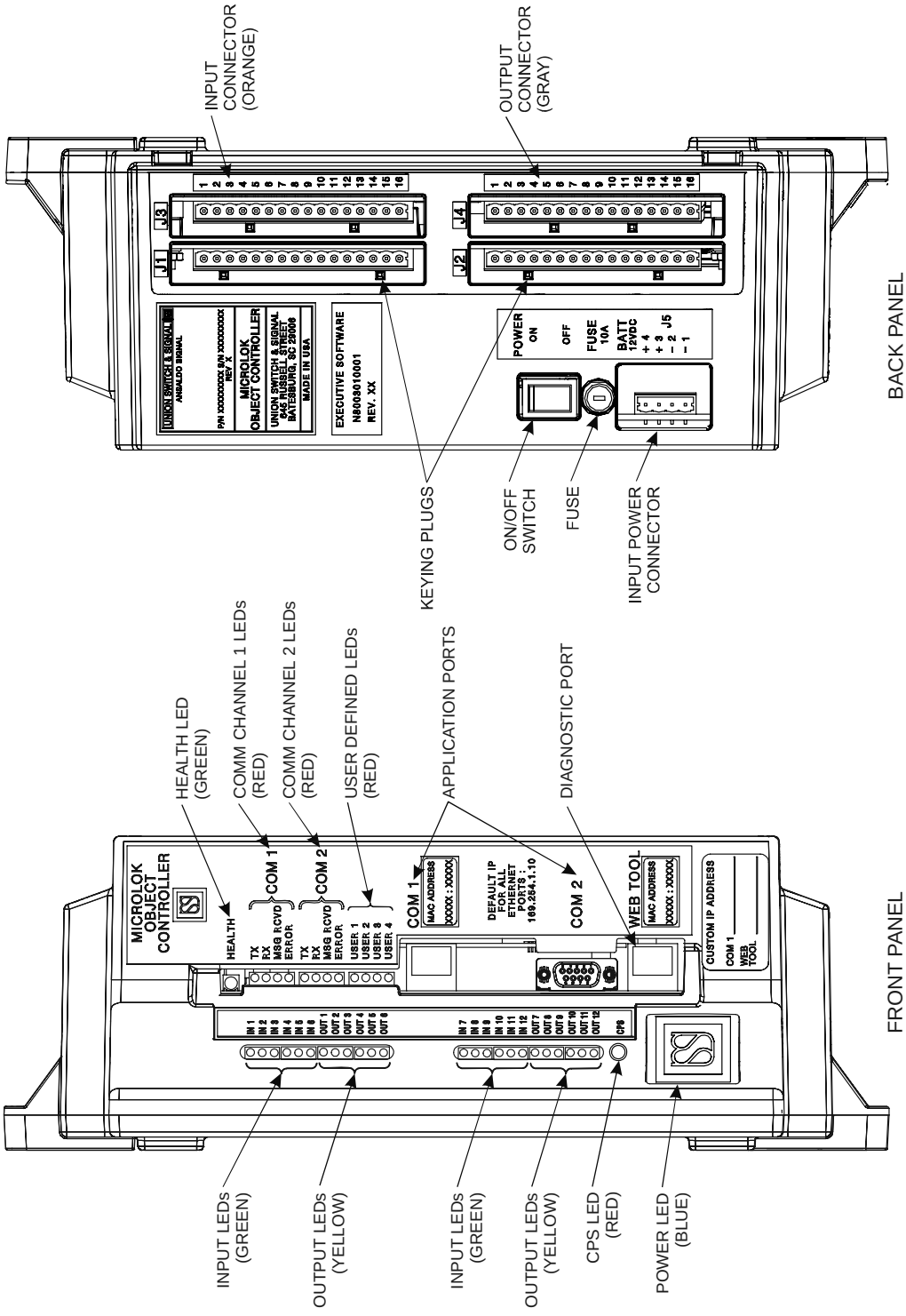


Figure 3-6. Object Controller N17700107 Front and Rear Panels

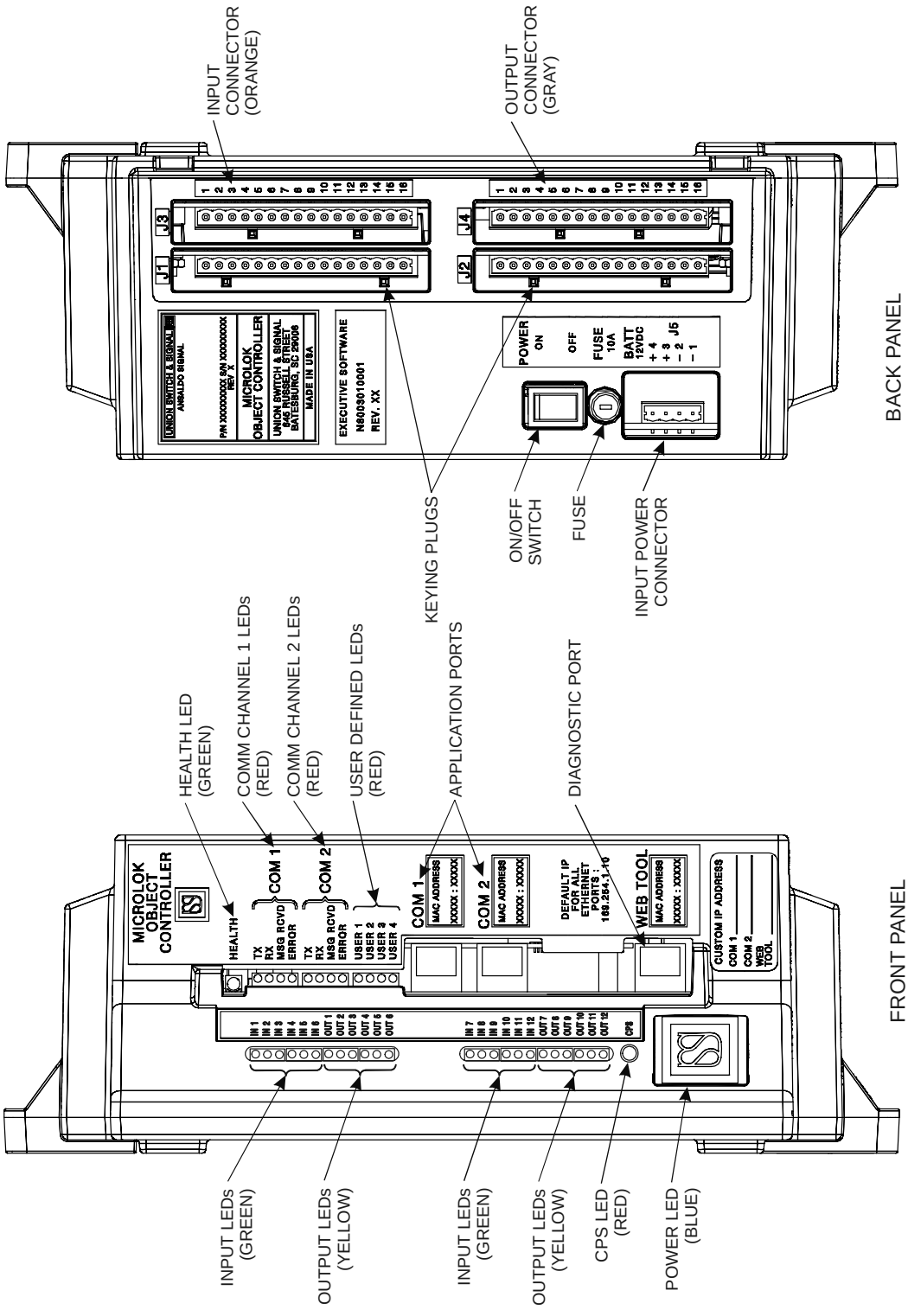


Figure 3-7. Object Controller N17700108 Front and Rear Panels

Table 3-6. Front Panel LED Operation

(Part numbers N17700111, Figure 3-8, and N1770112, Figure 3-9)

LED DESIGNATION	LED COLOR	FUNCTION
HEALTH	Green	Indicates the OC's health; this LED flashes at a rate of once per second when the unit is operating properly.
COM 1 TX	Red	Flashes to indicate that data are being transmitted.
COM 1 RX	Red	Flashes to indicate that good data are being received.
COM 1 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 1 ERROR	Red	Indicates that there is an error with the received data.
COM 2 TX	Red	Flashes to indicate that data are being transmitted.
COM 2 RX	Red	Flashes to indicate that good data are being received.
COM 2 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 2 ERROR	Red	Indicates that there is an error with the received data.
USER 1 USER 2 USER 3 USER 4	Red	User defined in the application software.
Ethernet Port LEDs	Yellow	Indicates correct wiring between this port and a hub. The LED is ON when the wiring is good.
Ethernet Port LEDs	Green	Turns ON at power up and turns OFF after approximately 1 minute when it resets.
IN 1 IN 2 IN 3 IN 4 IN 5 IN 6	Green	Indicates that Vital Inputs No. 1 through No. 6 are energized. Power connection is at the upper board orange connector J1 on the rear of the unit.
US&S Logo	Blue	This is the power indicator and is ON when power is applied to the unit.

NOTE

All isolation is lost between the two outputs or inputs when configured as a bi-polar pair.

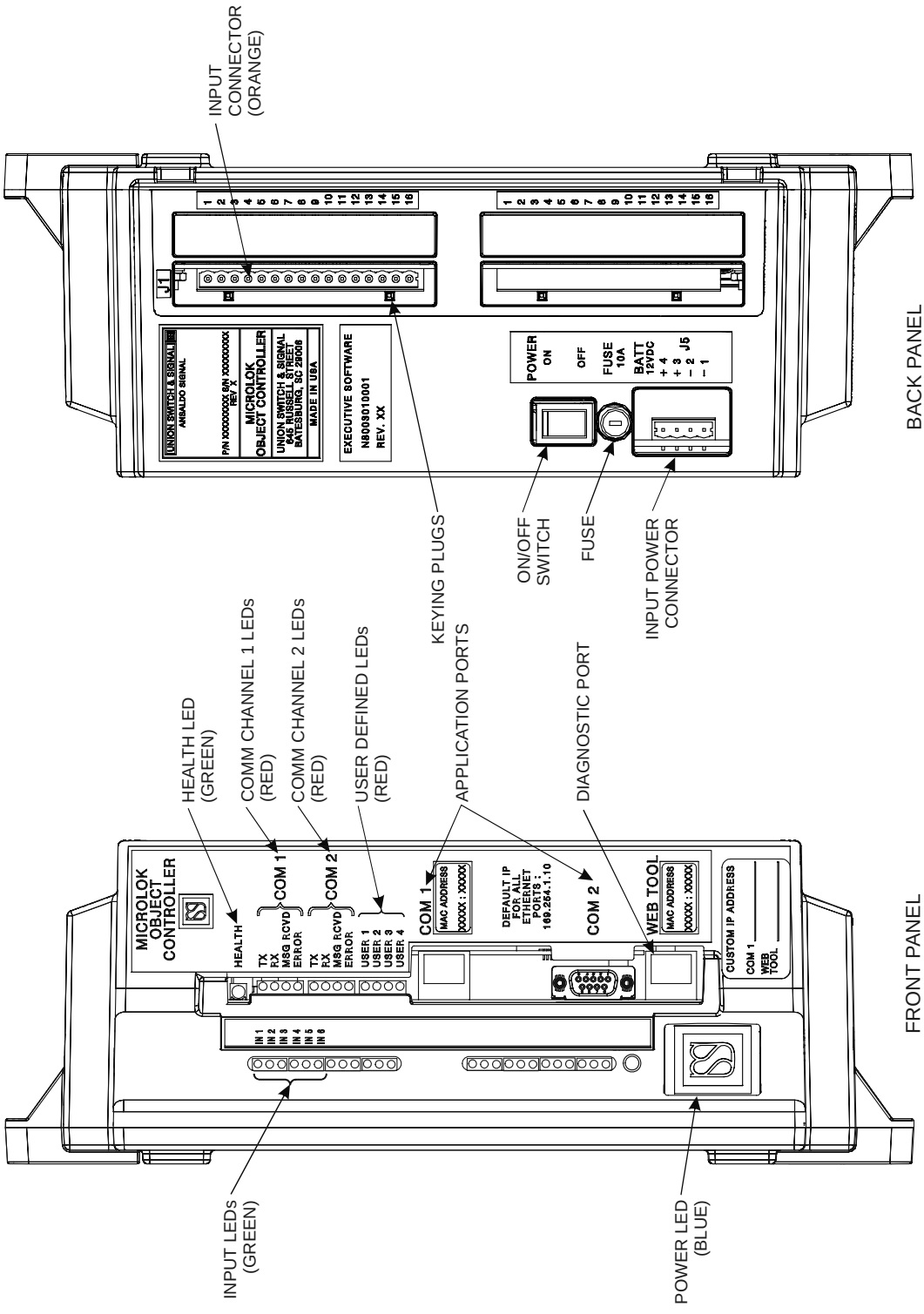


Figure 3-8. Object Controller N17700111 Front and Rear Panels

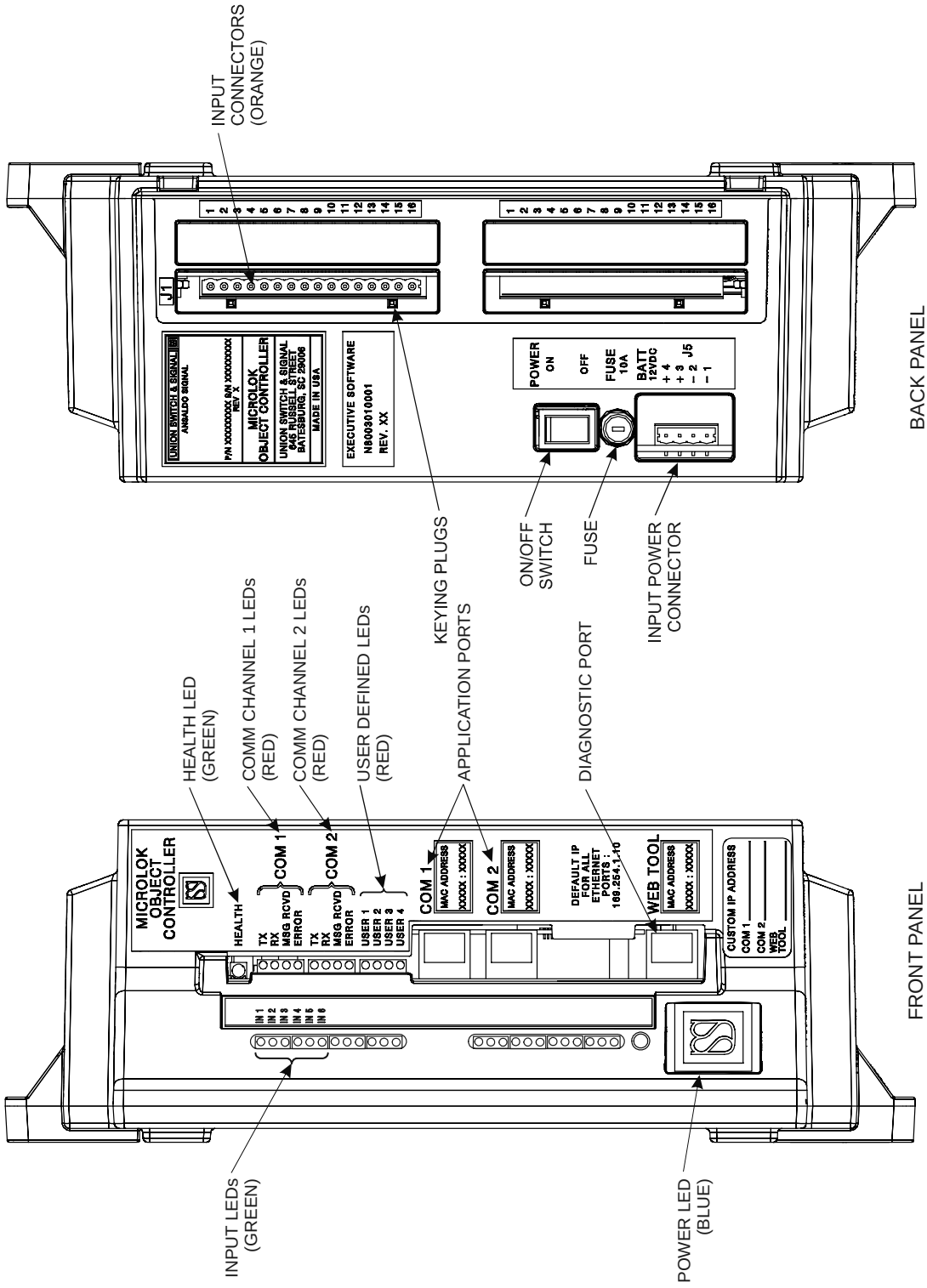


Figure 3-9. Object Controller N17700112 Front and Rear Panels

Table 3-7. Front Panel LED Operation

(Part numbers N17700115, Figure 3-10, and N1770116, Figure 3-11)

LED DESIGNATION	LED COLOR	FUNCTION
HEALTH	Green	Indicates the OC's health, this LED flashes at a rate of once per second when the unit is operating properly.
COM 1 TX	Red	Flashes to indicate that data are being transmitted.
COM 1 RX	Red	Flashes to indicate that good data are being received.
COM 1 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 1 ERROR	Red	Indicates that there is an error with the received data.
COM 2 TX	Red	Flashes to indicate that data are being transmitted.
COM 2 RX	Red	Flashes to indicate that good data are being received.
COM 2 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 2 ERROR	Red	Indicates that there is an error with the received data.
USER 1 USER 2 USER 3 USER 4	Red	User defined in the application software.
Ethernet port LED's	Yellow	Indicates correct wiring between this port and a hub. The LED is ON when the wiring is good.
Ethernet port LED's	Green	Turns ON at power up and turns OFF after approximately 1 minute when it resets.
FAULT	Green	Indicates a fault within the LED signal(s) or a problem with the wiring.
NV IN	Green	Indicates that the Non-Vital Input is energized.
NV OUT	Green	Indicates that the Non-Vital Output is energized.
LED 1 LED 2 LED 3 LED 4 LED 5 LED 6	Yellow	Indicates that LED Signal Outputs No. 1 through No. 6 are energized. A fault condition is indicated by three quick on pulses followed by a longer off period. LED signal connections are at the upper board gray connector J2 on the rear of the unit.
CPS	Red	Indicates that the Conditional Power Supply is operational.
US&S Logo	Blue	This is the power indicator and is ON when power is applied to the unit.

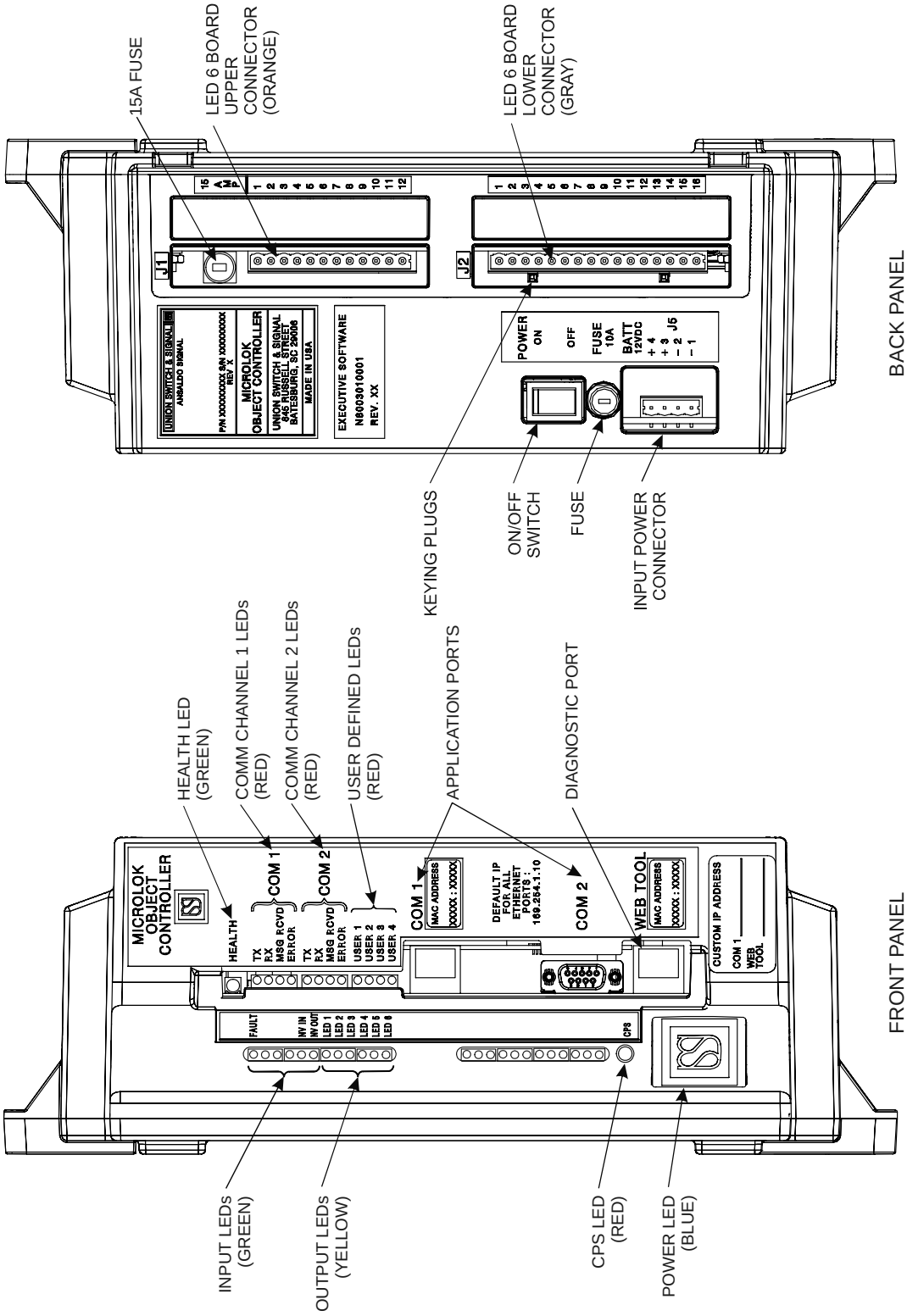


Figure 3-10. Object Controller N17700115 Front and Rear Panels

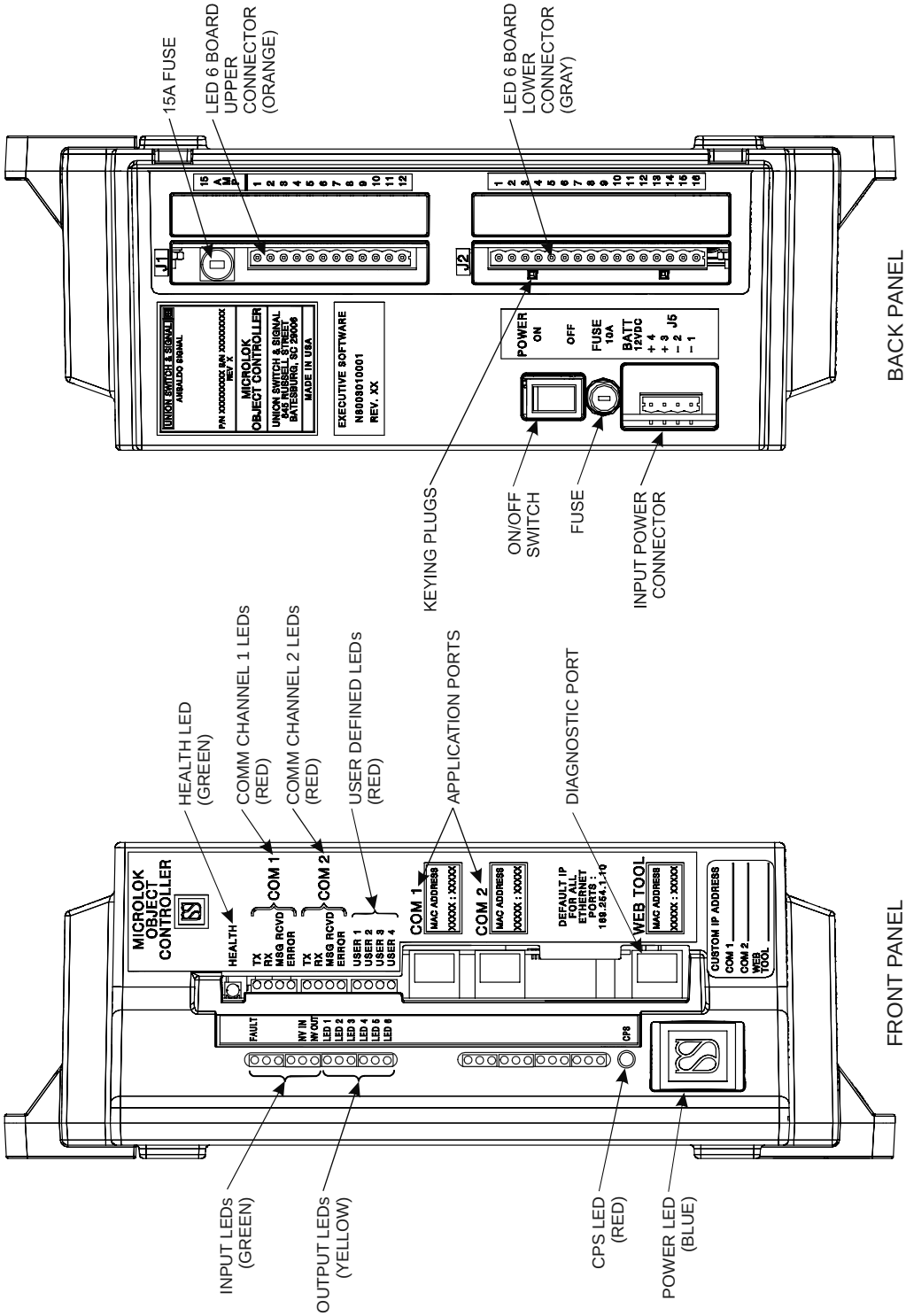


Figure 3-11. Object Controller N17700116 Front and Rear Panels

Table 3-8. Front Panel LED Operation

(Part numbers N17700117, Figure 3-12, and N1770118, Figure 3-13)

LED DESIGNATION	LED COLOR	FUNCTION
HEALTH	Green	Indicates the OC's health, this LED flashes at a rate of once per second when the unit is operating properly.
COM 1 TX	Red	Flashes to indicate that data are being transmitted.
COM 1 RX	Red	Flashes to indicate that good data are being received.
COM 1 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 1 ERROR	Red	Indicates that there is an error with the received data.
COM 2 TX	Red	Flashes to indicate that data are being transmitted.
COM 2 RX	Red	Flashes to indicate that good data are being received.
COM 2 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 2 ERROR	Red	Indicates that there is an error with the received data.
USER 1 USER 2 USER 3 USER 4	Red	User defined in the application software.
Ethernet port LED's	Yellow	Indicates correct wiring between this port and a hub. The LED is ON when the wiring is good.
Ethernet port LED's	Green	Turns ON at power up and turns OFF after approximately 1 minute when it resets.
FAULT	Green	Indicates a fault within the LED signal(s) or a problem with the wiring.
NV IN	Green	Indicates that the Non-Vital Input is energized.
NV OUT	Green	Indicates that the Non-Vital Output is energized.
LED 1 LED 2 LED 3 LED 4 LED 5 LED 6	Yellow	Indicates that LED Signal Outputs No. 1 through No. 6 are energized. A fault condition is indicated by three quick on pulses followed by a longer off period. LED signal connections are at the upper board gray connector J2 on the rear of the unit.
IN 1 IN 2 IN 3 IN 4 IN 5 IN 6	Green	Indicates that Vital Inputs No. 1 through No. 6 are energized. Power connection is at the lower orange connector J3 on the rear of the unit.
OUT 1 OUT 2 OUT 3 OUT 4 OUT 5 OUT 6	Yellow	Indicates that Vital Outputs No. 1 through No. 6 are energized. Power connection is at the lower gray connector J4 on the rear of the unit.
CPS	Red	Indicates that the Conditional Power Supply is operational.
US&S Logo	Blue	This is the power indicator and is ON when power is applied to the unit.

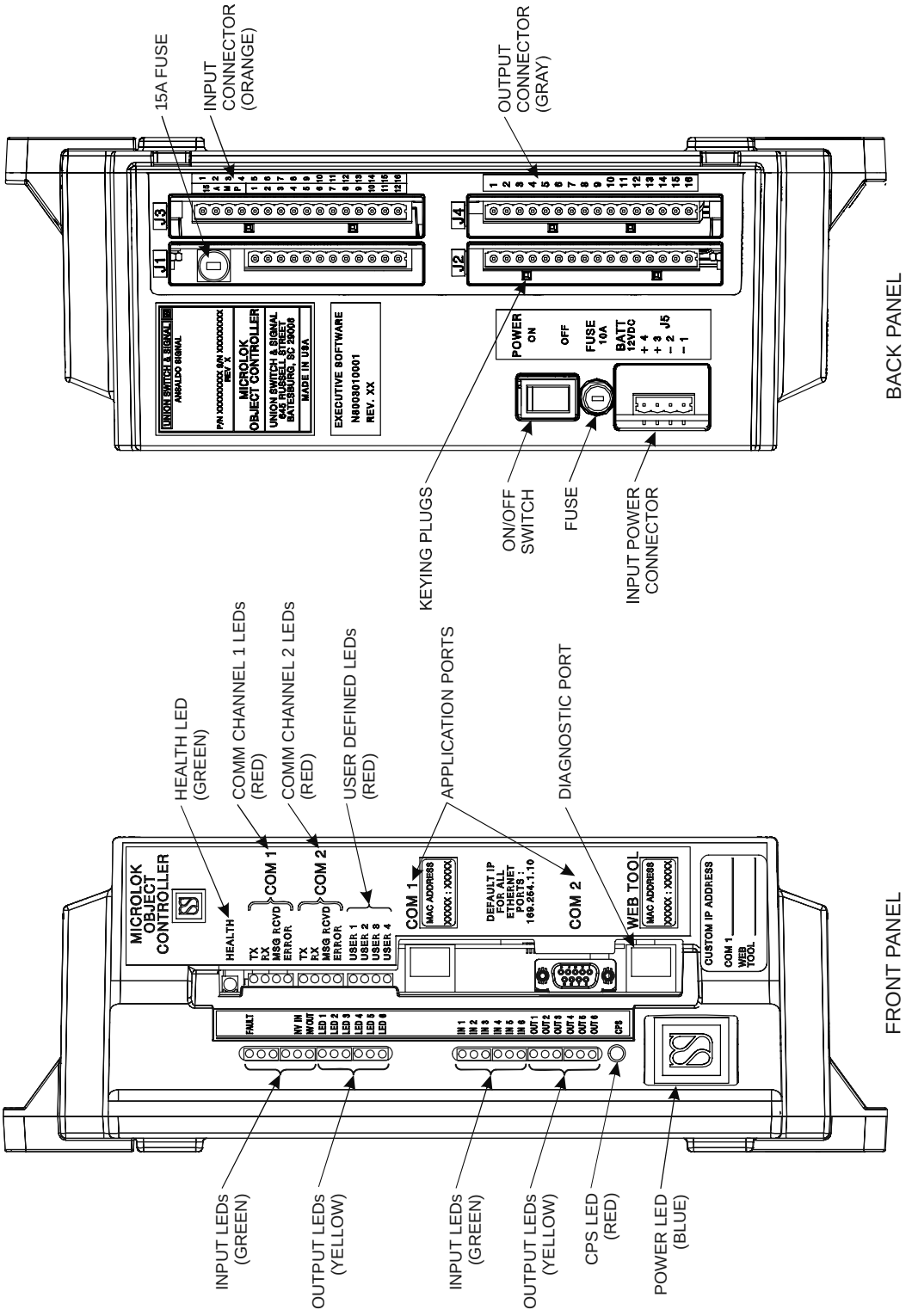


Figure 3-12. Object Controller N17700117 Front and Rear Panels

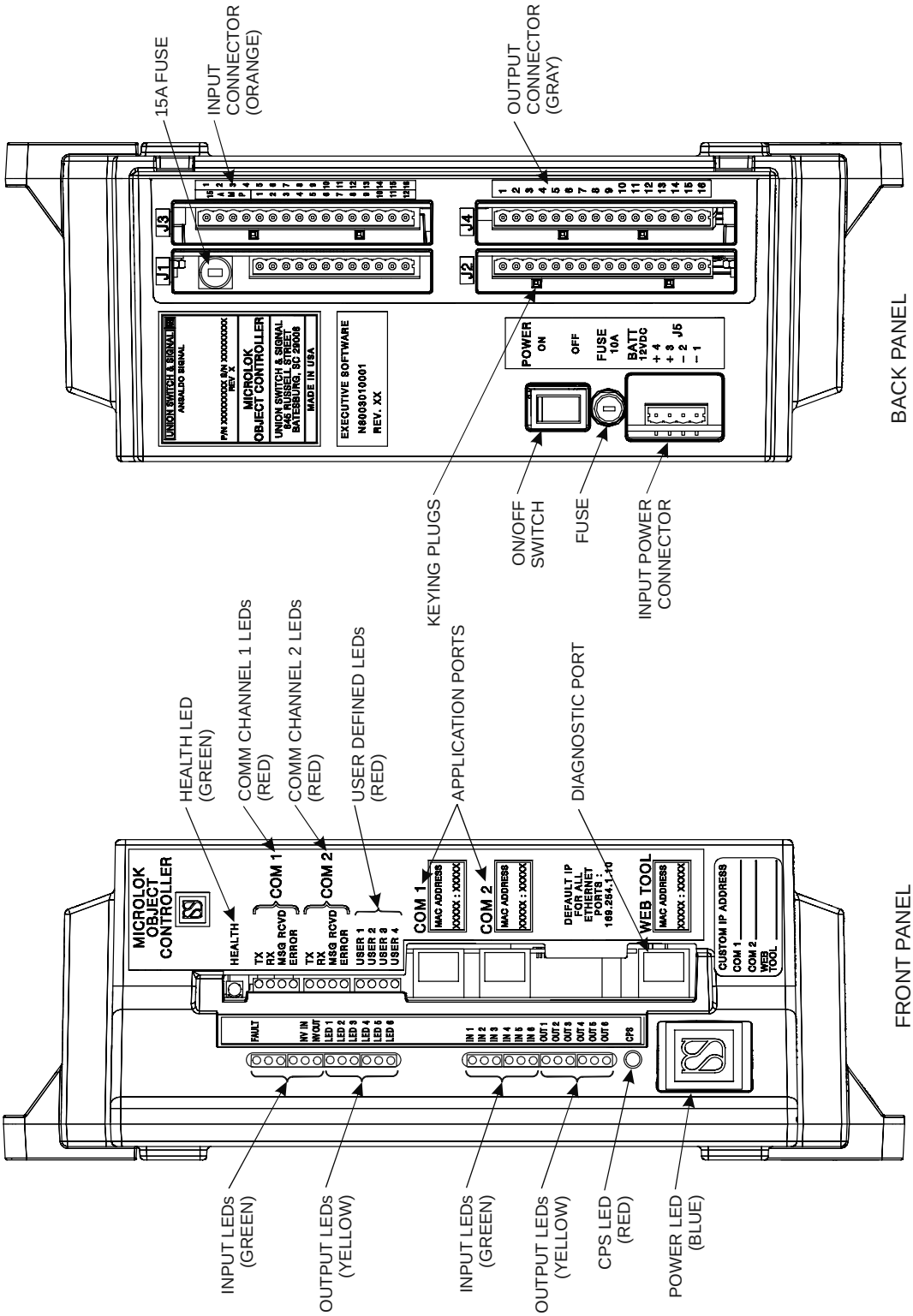


Figure 3-13. Object Controller N17700118 Front and Rear Panels

Table 3-9. Front Panel LED Operation

(Part number N17700119, Figure 3-14)

LED DESIGNATION	LED COLOR	FUNCTION
HEALTH	Green	Indicates the OC's health; this LED flashes at a rate of once per second when the unit is operating properly.
COM 1 TX	Red	Flashes to indicate that data are being transmitted.
COM 1 RX	Red	Flashes to indicate that good data are being received.
COM 1 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 1 ERROR	Red	Indicates that there is an error with the received data.
COM 2 TX	Red	Flashes to indicate that data are being transmitted.
COM 2 RX	Red	Flashes to indicate that good data are being received.
COM 2 MSG RCVD	Red	Flashes to indicate that a good address and good data have been received.
COM 2 ERROR	Red	Indicates that there is an error with the received data.
USER 1 USER 2 USER 3 USER 4	Red	User defined in the application software.
Ethernet Port LEDs	Yellow	Indicates correct wiring between this port and a hub. The LED is ON when the wiring is good.
Ethernet Port LEDs	Green	Turns ON at power up and turns OFF after approximately 1 minute when it resets.
IN 1 IN 2 IN 3 IN 4 IN 5 IN 6	Green	Indicates that Vital Inputs No. 1 through No. 6 are energized. Power connection is at the upper board orange connector J1 on the rear of the unit.
OUT 1 OUT 2 OUT 3 OUT 4 OUT 5 OUT 6	Yellow	Indicates that Vital Outputs No. 1 through No. 6 are energized. Power connection is at the upper board gray connector J2 on the rear of the unit.
IN 7 IN 8 IN 9 IN 10 IN 11 IN 12	Green	Indicates that Vital Inputs No. 7 through No. 12 are energized. Power connection is at the lower board orange connector J3 on the rear of the unit.
OUT 7 OUT 8 OUT 9 OUT 10 OUT 11 OUT 12	Yellow	Indicates that Vital Outputs No. 7 through No. 12 are energized. Power connection is at the lower board gray connector J4 on the rear of the unit.
CPS	Red	Indicates that the Conditional Power Supply is operational, supplying power to the vital outputs.
US&S Logo	Blue	This is the power indicator and is ON when power is applied to the unit.

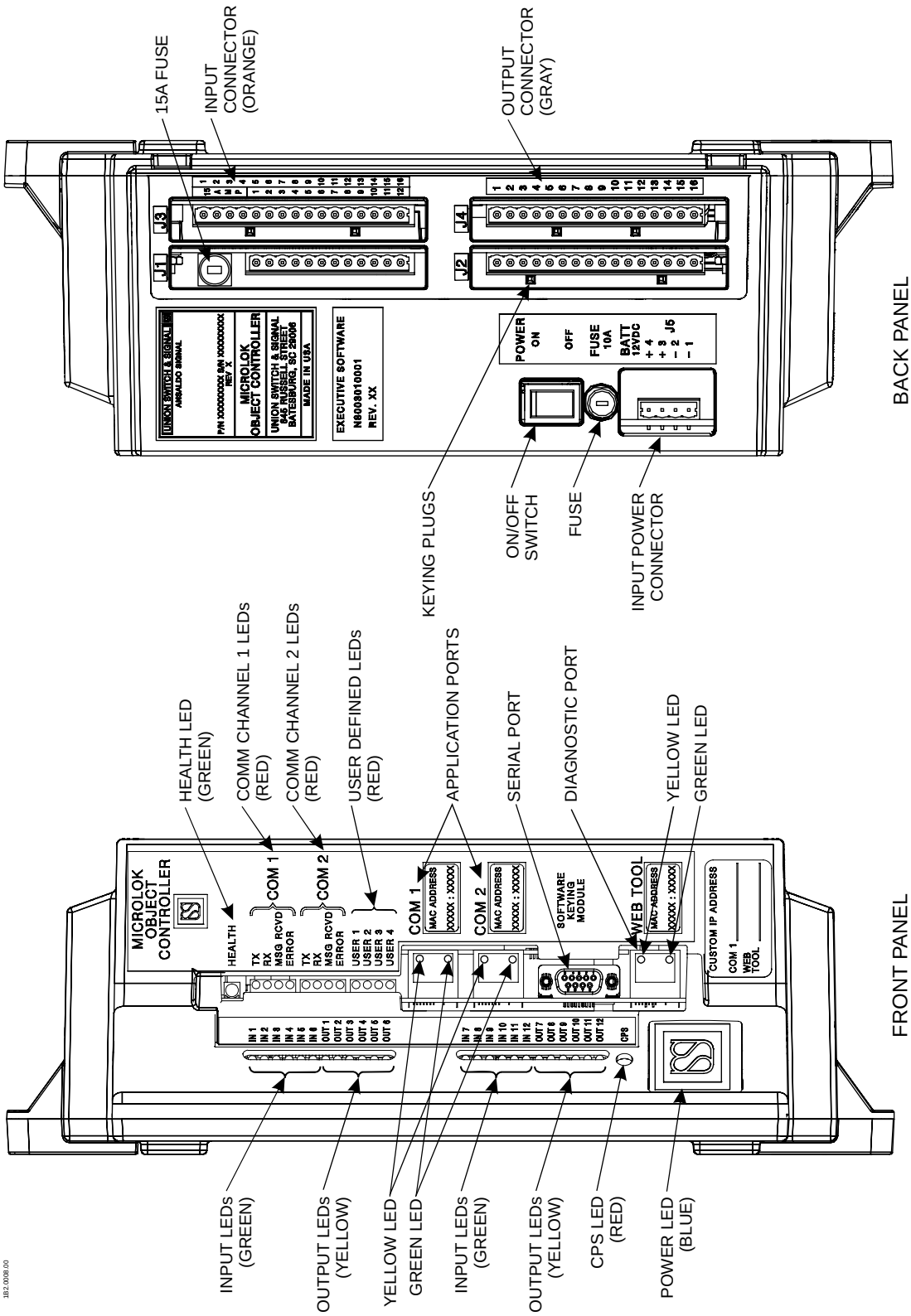


Figure 3-14. Object Controller N17700119 Front and Rear Panels

3.1. Connection Diagrams

The various connection wiring schemes for the OC are shown in Figure 3-15 through Figure 3-24.

NOTE

Bi-polar inputs require the use of 2 inputs and bi-polar outputs require the use of 2 outputs.

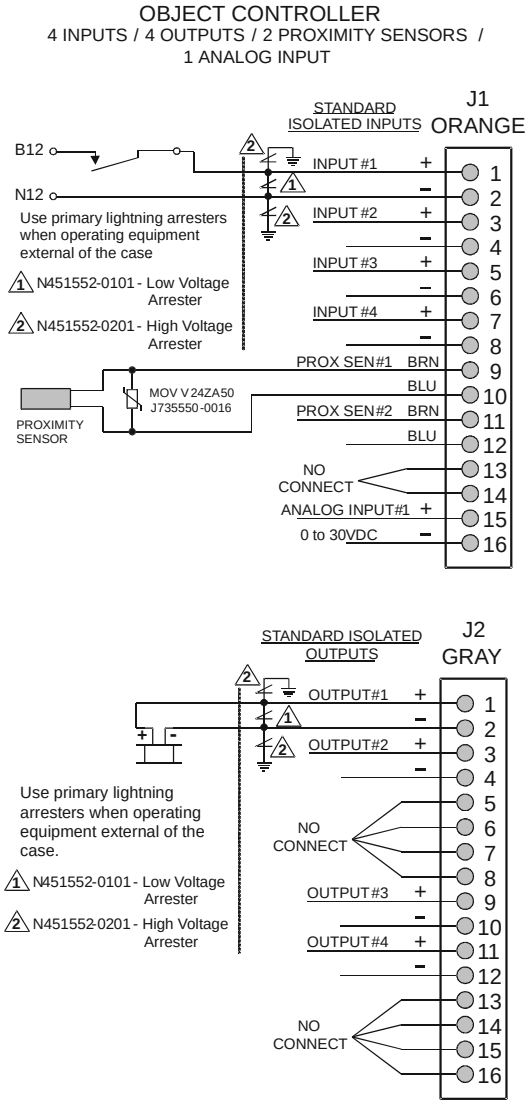


Figure 3-15. Standard Inputs and Outputs for Part Numbers N17700101 and N17700102
(Proximity sensor is ordered separately)
Surge protection is required across each sensor input
(MOV No. V24ZA50, ASTS USA J735550-0016 - ordered separately.)

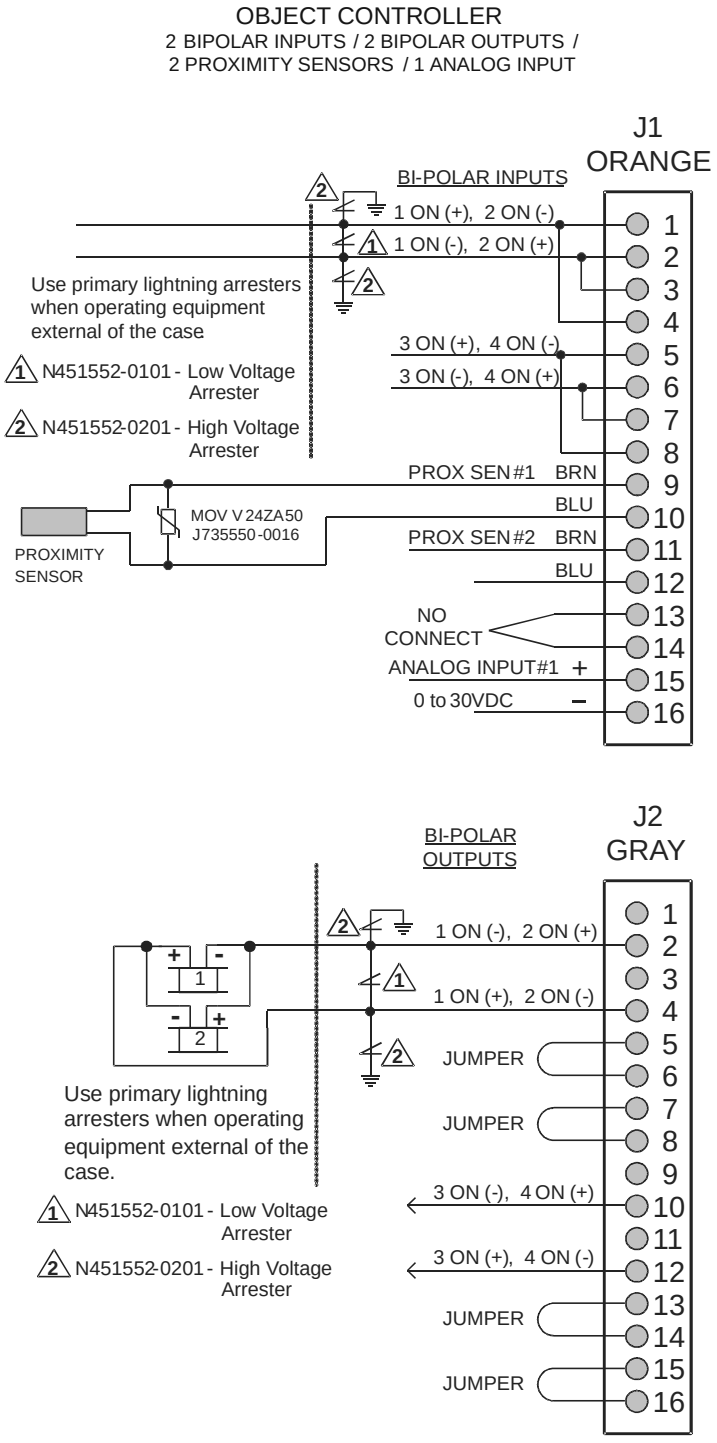


Figure 3-16. Bipolar Inputs and Outputs for Part Numbers N17700101 and N17700102

(with proximity sensor - ordered separately)

Surge protection is required across each sensor input

(MOV No. V24ZA50, ASTS USA J735550-0016 - ordered separately.)

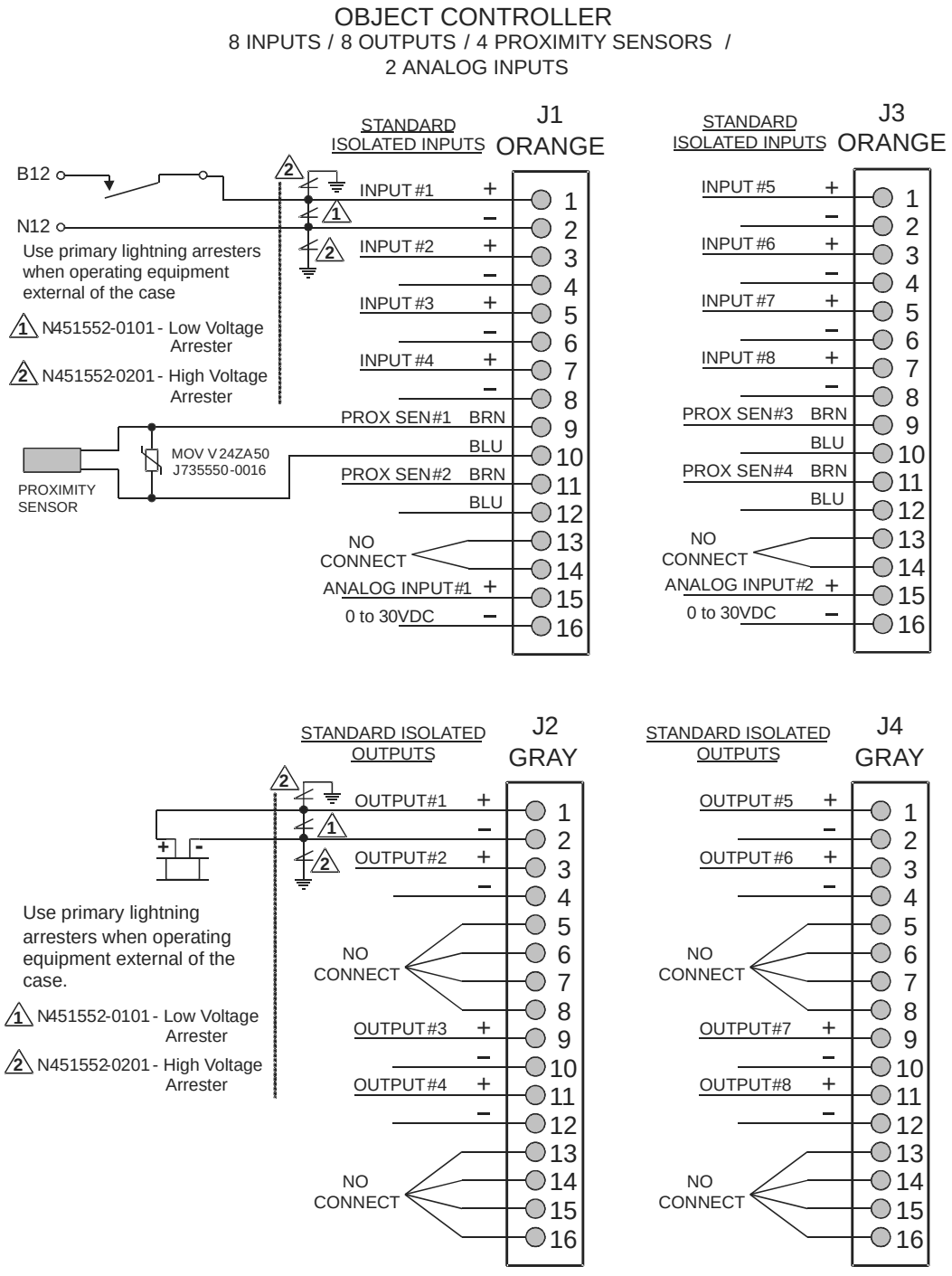


Figure 3-17. Standard Inputs and Outputs for Part Number N17700103

(with proximity sensor - ordered separately)

Surge protection is required across each sensor input

(MOV No. V24ZA50, ASTS USA J735550-0016 - ordered separately.)

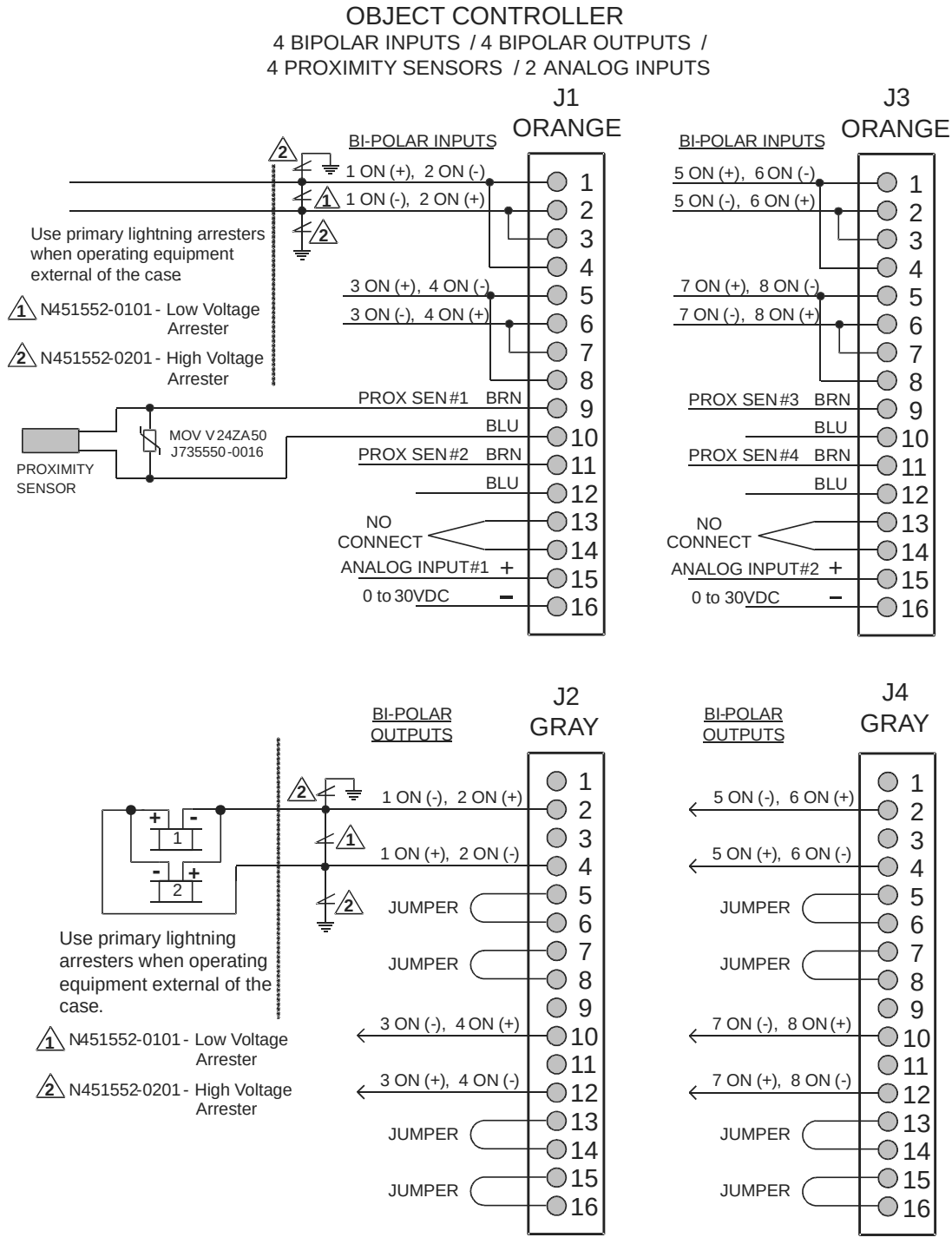
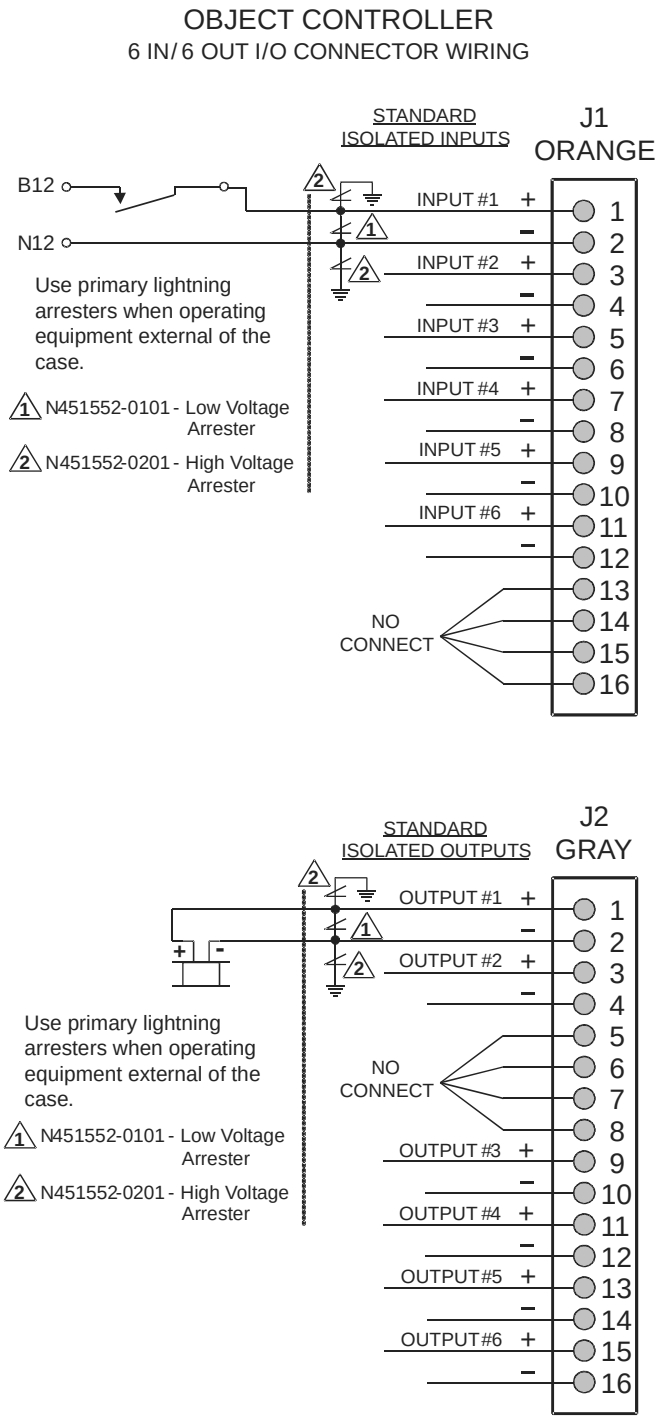


Figure 3-18. Bipolar Inputs and Outputs for Part Number N17700103

(Proximity sensor is ordered separately)

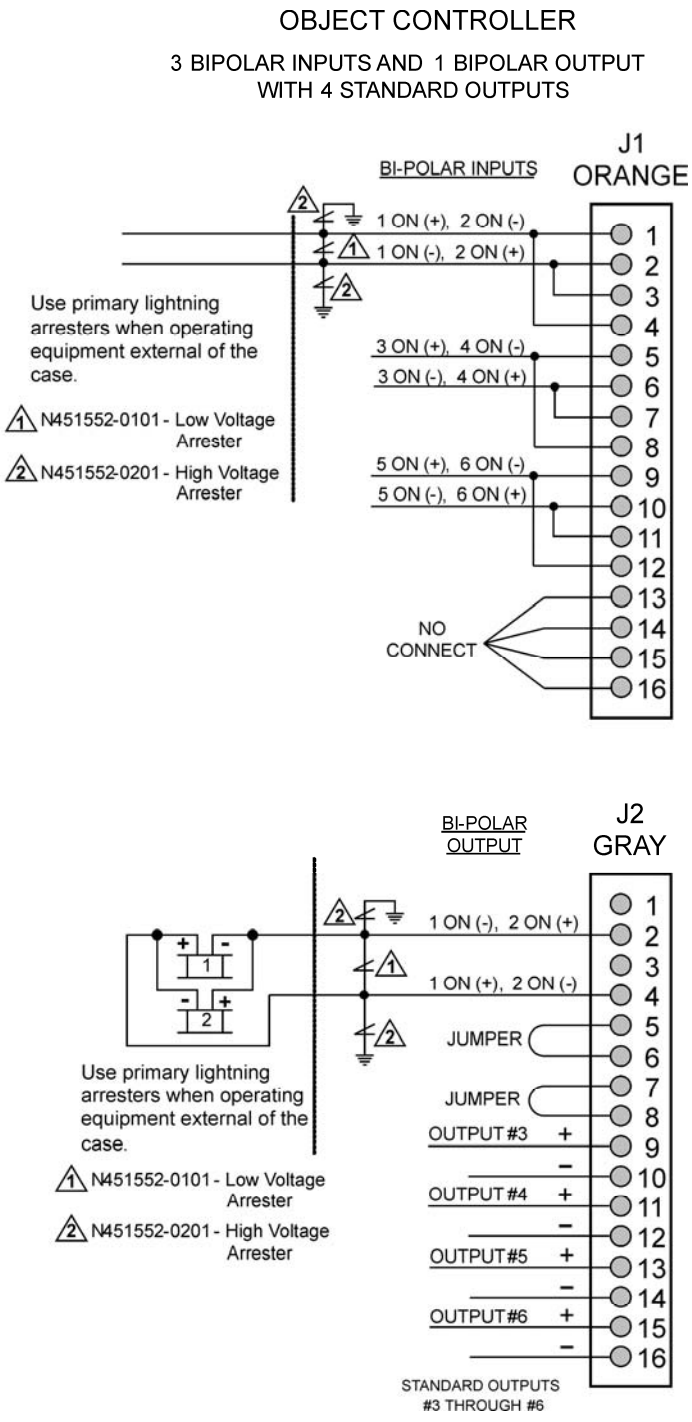
Surge protection is required across each sensor input

(MOV No. V24ZA50, ASTS USA J735550-0016 - ordered separately.)



Part numbers N17700111 and N17700112 do not use J2

Figure 3-19. Standard Inputs and Outputs for Part Numbers N17700105, N17700106, N17700111, and N17700112


OBJECT CONTROLLER
3 BIPOLAR INPUTS AND 1 BIPOLAR OUTPUT
WITH 4 STANDARD OUTPUTS
J1
ORANGE
BI-POLAR INPUTS
1 ON (+), 2 ON (-)
1 ON (-), 2 ON (+)
3 ON (+), 4 ON (-)
3 ON (-), 4 ON (+)
5 ON (+), 6 ON (-)
5 ON (-), 6 ON (+)
NO CONNECT
Use primary lightning arresters when operating equipment external of the case.
1 N451552-0101 - Low Voltage Arrester
2 N451552-0201 - High Voltage Arrester
J2
GRAY
BI-POLAR OUTPUT
1 ON (-), 2 ON (+)
1 ON (+), 2 ON (-)
JUMPER
JUMPER
OUTPUT #3 +
OUTPUT #4 +
OUTPUT #5 +
OUTPUT #6 +
STANDARD OUTPUTS #3 THROUGH #6

Part numbers N17700111 and N17700112 do not use J2

Figure 3-20. Bipolar Inputs and Outputs for Part Numbers N17700105, N17700106, N17700111, and N17700112

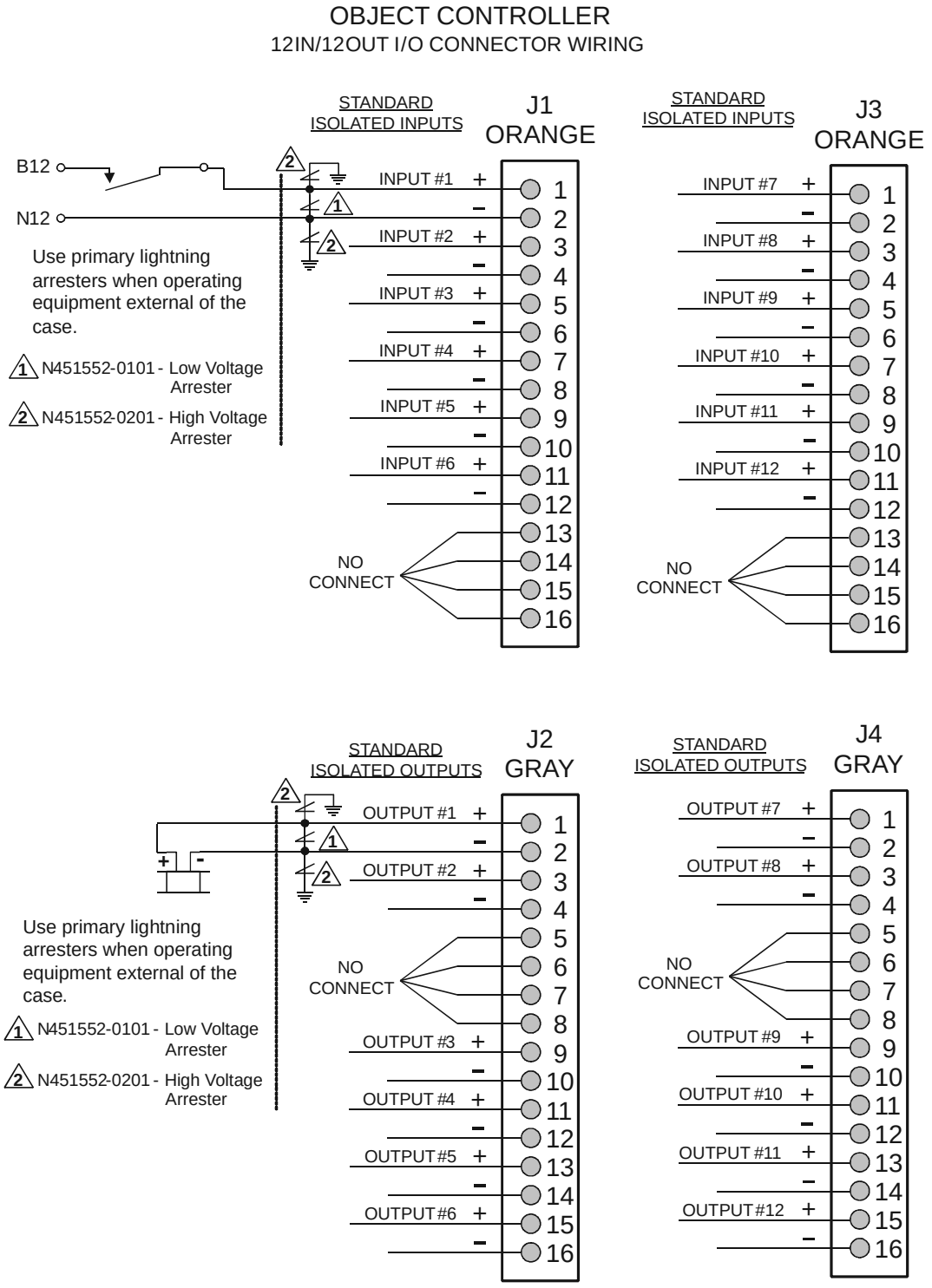


Figure 3-21. Standard Inputs and Outputs for Part Numbers N17700107, N17700108, and N17700119

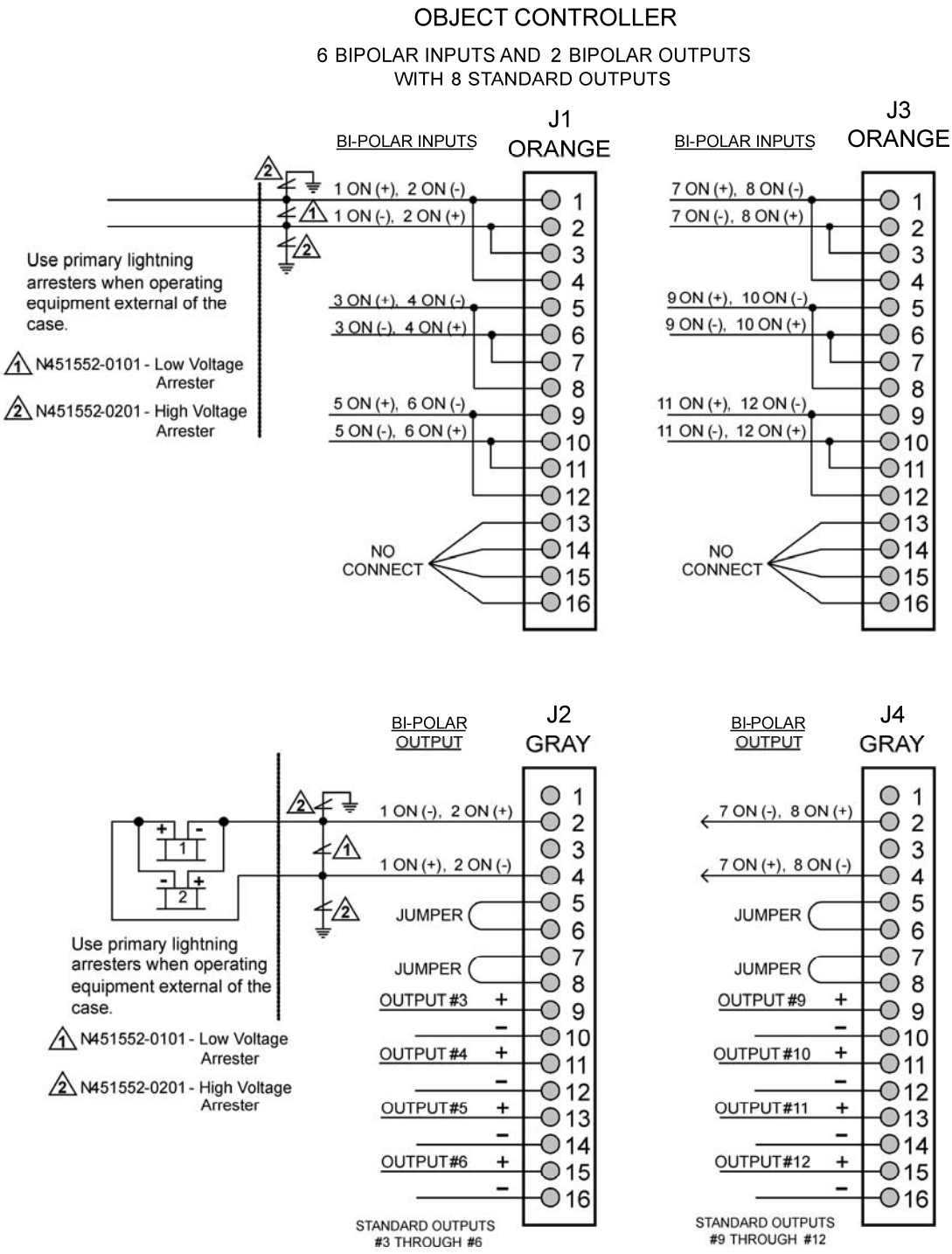

OBJECT CONTROLLER
6 BIPOLAR INPUTS AND 2 BIPOLAR OUTPUTS
WITH 8 STANDARD OUTPUTS
J1
ORANGE
BI-POLAR INPUTS
1 ON (+), 2 ON (-)
1 ON (-), 2 ON (+)
3 ON (+), 4 ON (-)
3 ON (-), 4 ON (+)
5 ON (+), 6 ON (-)
5 ON (-), 6 ON (+)
NO CONNECT
J3
ORANGE
BI-POLAR INPUTS
7 ON (+), 8 ON (-)
7 ON (-), 8 ON (+)
9 ON (+), 10 ON (-)
9 ON (-), 10 ON (+)
11 ON (+), 12 ON (-)
11 ON (-), 12 ON (+)
NO CONNECT
Use primary lightning arresters when operating equipment external of the case.
1 N451552-0101 - Low Voltage Arrester
2 N451552-0201 - High Voltage Arrester
J2
GRAY
BI-POLAR OUTPUT
1 ON (-), 2 ON (+)
1 ON (+), 2 ON (-)
JUMPER
JUMPER
OUTPUT #3 +
OUTPUT #4 +
OUTPUT #5 +
OUTPUT #6 +
STANDARD OUTPUTS #3 THROUGH #6
J4
GRAY
BI-POLAR OUTPUT
7 ON (-), 8 ON (+)
7 ON (+), 8 ON (-)
JUMPER
JUMPER
OUTPUT #9 +
OUTPUT #10 +
OUTPUT #11 +
OUTPUT #12 +
STANDARD OUTPUTS #9 THROUGH #12
Use primary lightning arresters when operating equipment external of the case.
1 N451552-0101 - Low Voltage Arrester
2 N451552-0201 - High Voltage Arrester

Figure 3-22. Bipolar Inputs and Outputs for Part Numbers N17700107, N17700108, and N17700119

NOTE

In Figure 3-23and Figure 3-24 there is only one Signal Output that is displayed. The remaining five Signal Outputs are wired in the same manner.

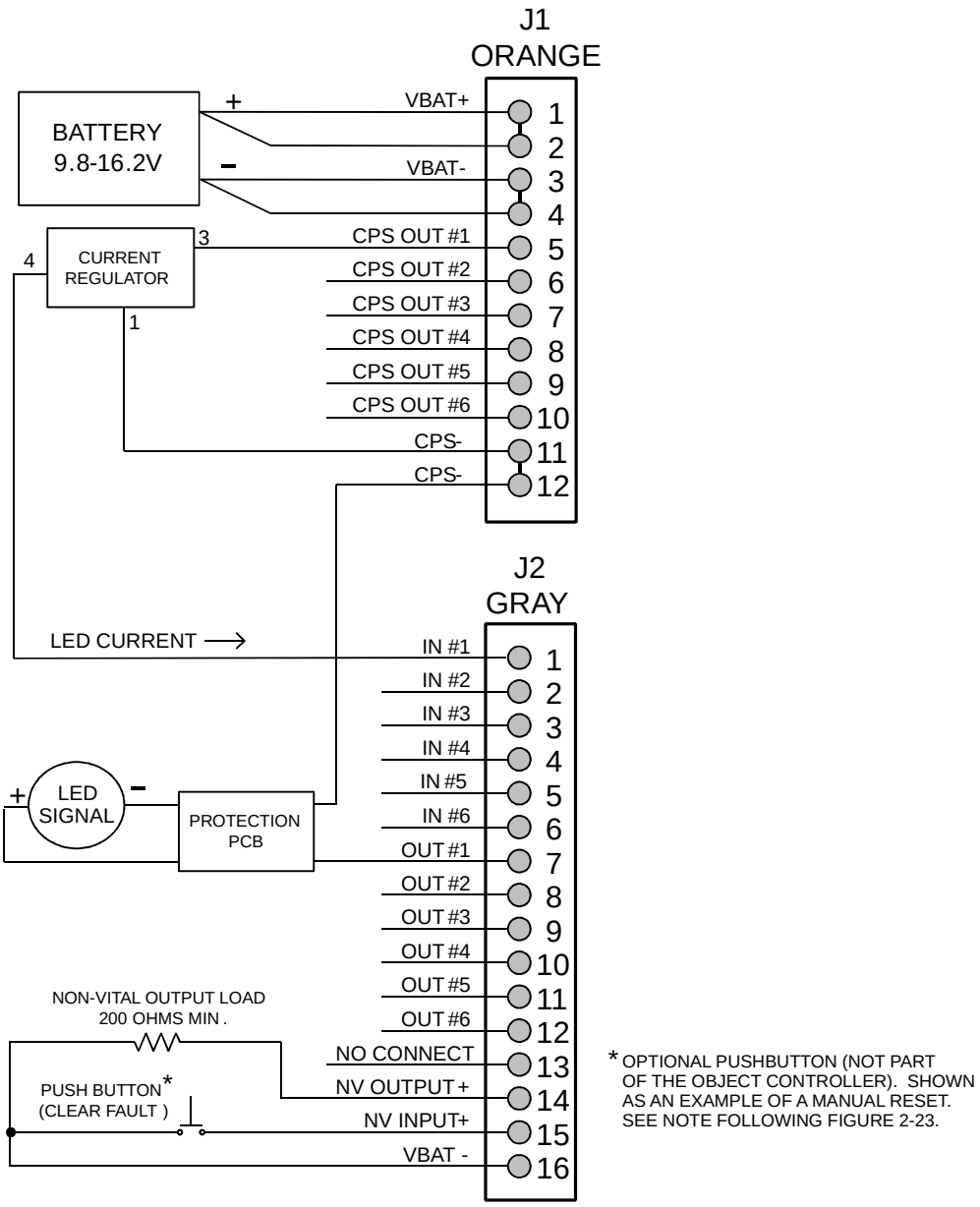


Figure 3-23. Standard Outputs for Part Numbers N17700115 and N17700116

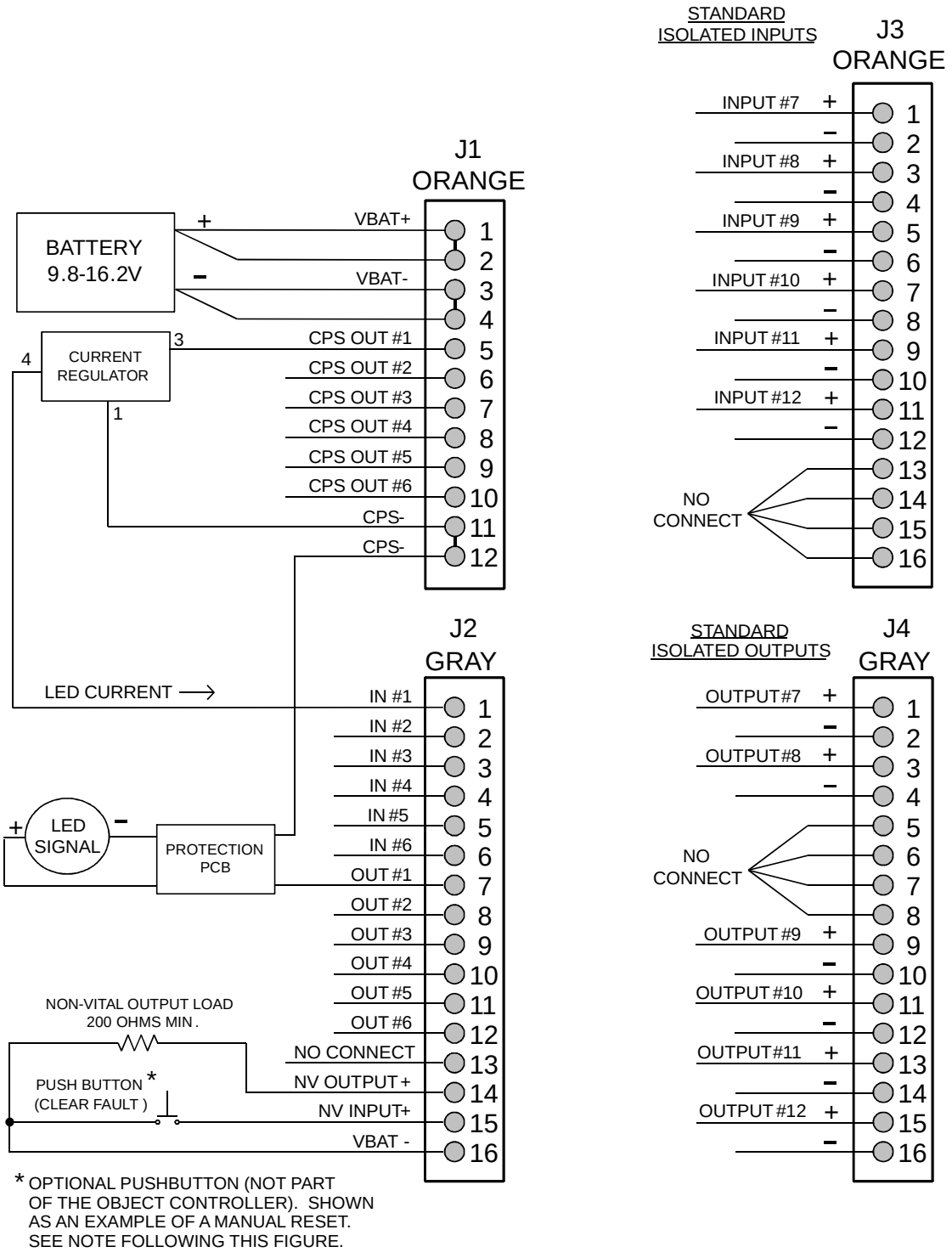


Figure 3-24. Standard Inputs and Outputs for Part Numbers N17700117 and N17700118

NOTE

In Figure 3-23and Figure 3-24 there is a Push Button displayed, that does not come as a part of these packages. The Push Button is used as an example of what can be connected to the Non-Vital Input connection of the LED6 PCB.

When coupled with application logic, the optional push button shown in the figures can be used to reset the signal failover. This push button setup mimics the reset button located on the MICROLOK LED12 board.

Please note that an external push button reset is not required on the OC. The signal failover reset function can be performed completely within the application logic.

For a more detailed representation on how to wire the IN6.OUT6 PCB for standard inputs and outputs, refer to Figure 3-19, and for bi-polar inputs and outputs, refer to Figure 3-20.

NOTE

The wiring diagrams for Figure 3-19 and Figure 3-20 show how to wire the IN6.OUT6 PCB in the top position using J1 and J2, but for N17700117 and N17700118, the IN6.OUT6 PCB must be in the bottom position using J3 and J4.

3.1.1. Ethernet Port Pin Orientation

The pin orientation of the Ethernet connector is shown in Figure 3-25. The pin assignments are presented in Table 3-10.

3.1.2. Power Connections

The power connectors and the WAGO connectors are shown in Figure 3-26.

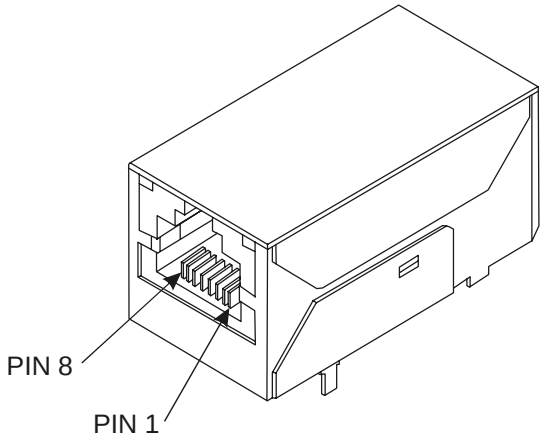
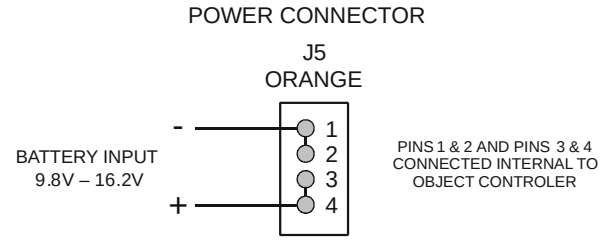
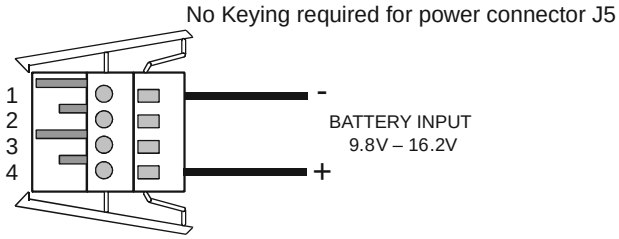


Figure 3-25. Ethernet Interface Pin Orientation

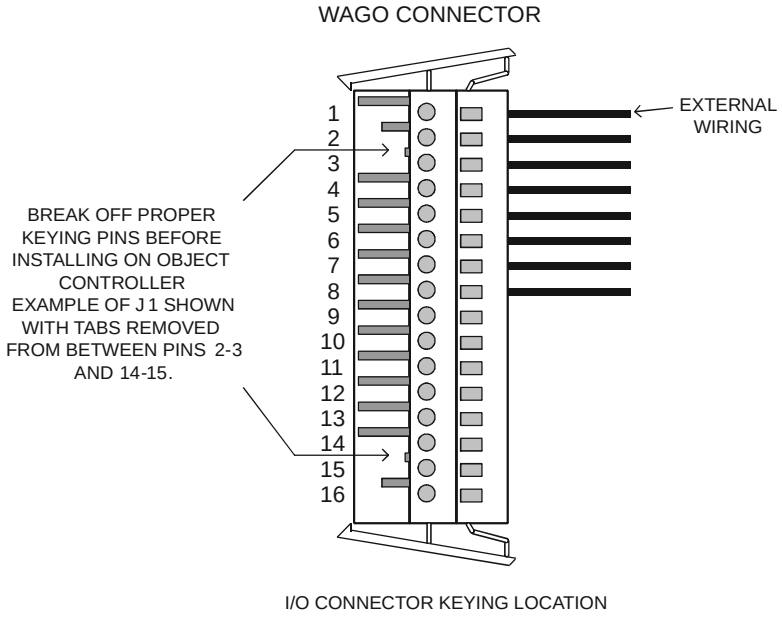
Table 3-10. Ethernet Interface Connector Pin Assignments

PIN 1 (TXD+)	PIN 2 (TXD-)	PIN 3 (RXD+)	PIN 4 (EPWR+)	PIN 5 (EPWR+)	PIN 6 (RXD-)	PIN 7 (EPWR-)	PIN 8 (EPWR-)
Transmit Data +	Transmit Data -	Receiver Data +	Power from Switch +	Power from Switch +	Receive Data -	Power from Switch -	Power from Switch -





Note : Secondary battery surge protection not required.



(See Figure 1-5 for Key Positions)

Figure 3-26. Power and WAGO Connectors

3.1.3. RS-232 DB-9 Pin Assignments

The pin assignments for the RS-232 DB-9 connector is shown in Figure 3-27 and Table 3-11.

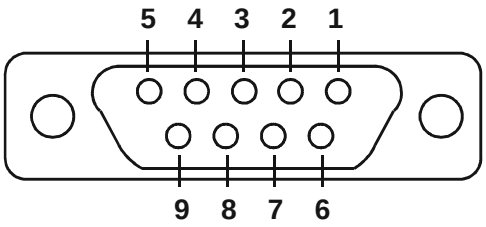


Figure 3-27. RS-232 DB-9 Pin Assignments (Front View)

Table 3-11. RS-232 DB-9 Pin Assignments

PIN	NAME	FUNCTION
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	No Connection	
5	COM	Signal Common
6	RXC	Receiver Clock
7	RTS	Request to Send
8	CTS	Clear to Send
9	TXC	Transmit Clock

3.2. Specifications

Electrical and environmental specifications for the OC are shown in Table 3-12.

Table 3-12. Functional Specifications

PARAMETER	VALUE
Protocols	GENISYS, MICROLOK, PEER
ELECTRICAL SPECIFICATIONS	
Input Power	12VDC (9.8 to 16.2VDC)
Current Draw	2 inputs and 2 outputs ON – 1.8 Amps
I/O Output	12 -14VDC
Output Load (Minimum Resistance)	200 ohms per discrete output 200 ohms per bi-polar pair
Maximum number of Outputs Turned On at the Same Time	6 (with 200-ohm loads)
Input Impedance	2000 ohms per discrete input 2000 ohms per bi-polar input
ENVIRONMENTAL SPECIFICATIONS	
Temperature	-40°C to +70°C
Shock and Vibration	Complies with AREMA Manual Part 11.5.1 - Class B environment
Isolation	2000VAC rms at 60Hz for 1 minute channel to channel

3.2.1. MIX I/O Board Specifications

The MIX I/O Board was designed to be a part of the Moveable Bridge Monitoring package, which is intended to detect the proper alignment of a moveable bridge, and indicate when the bridge is properly positioned. Using a proximity sensor mounted to the rails, the OC can detect if the rails and bridge are in the proper position, and provide a vital indication. The Bridge Monitor package also includes an analog input for battery monitoring. Table 3-13 presents the specifications for the analog input and the proximity sensors.

Notes:

- Threshold levels for the analog inputs are defined in tenths of a volt and range is defined from 0.0 to 30.0 volts.
- Target indication for any vital Object Controller application shall always be based on the current status of **two** proximity sensors inputs. (Example - one on each rail.)
- For vital applications, it is recommended that the application should be written so that a mismatch of stable paired proximity sensor inputs (i.e., one sensor input indicating and one sensor not indicating) results in the application logic interpreting the instability as a failure of one or more of the connected sensors. In this event the application logic will latch the condition to ensure a maintenance person is required to physically inspect the device(s) and make the needed repairs before normal operation is restored.

3.2.2. Proximity Sensors

The following guidelines must be used when using proximity sensors in an application.

- Target indication for any object controller application shall always be based on the current status of two proximity sensor inputs.
- A mismatch of stable paired proximity sensor inputs (i.e., one sensor input indicating and one sensor not indicating) shall require the maintenance person to physically inspect the device(s) and make the needed repairs before normal operation is restored.
- The proximity sensors shall not be located more than 100 feet away from the object controller no matter what size of wire being used.

Table 3-13. MIX I/O PCB Functional Specifications

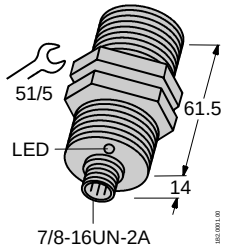
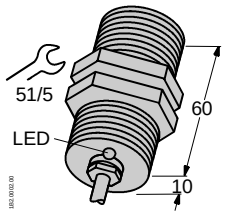
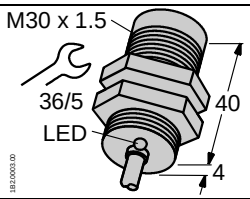
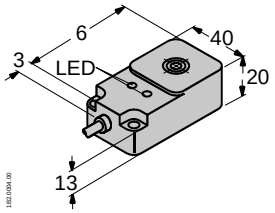
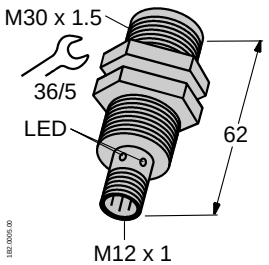
PARAMETER	VALUE
ANALOG INPUT SPECIFICATIONS	
Input Voltage Range	0 to 30VDC
Maximum Input Voltage	50VDC without damage to input (Input will only measure up to 30VDC)
Input Impendence	10K Ohms
Input Voltage Isolation	2000VAC between input leads and Battery
Accuracy	+/-0.2VDC from 0 to 10VDC +/-2.0% from 10 to 30VDC
Response Time	Intended for DC measurement only. Readings updated approximately once per second.
PROXIMITY SENSOR SPECIFICATIONS	
Surge Protection	Must use a ASTS USA Proximity Sensor with surge protection MOV at the junction box terminals located approximately six feet from sensor. Use MOV #V24ZA50, ASTS USA number J735550-0016.

Refer to Section 15.2.4.2.

- **<board name>.Proximity.Sensor.x** states whether the Proximity Sensor is Set (Touching) or Clear (Not Touching).
- If the **<board name>.Proximity.Sensor.x.Indeterminate** is set, this states that the Proximity Sensor is in an invalid state and the **<board name>.Proximity.Sensor.x** bit will be clear.

Table 3-14. Inductive Proximity Sensors

(with Extended Temperature Range – 40C to +70C)

PART NUMBER	CONNECTION TYPE	VOLTAGE	SENSOR*	CURRENT DISPLACEMENT RELATIONSHIP	
				DETECTION DISTANCE (MM/IN)	CURRENT (MA)
J7381040029	Quick Disconnect	10VDC		0-20mm ±2mm 0-0.787391 in ±0.0787391	0.35-1.20
				>23mm >0.9055091 in	4.0-7.5
J7381040030	Potted	10VDC		0-20mm ±2mm 0-0.787391 in ±0.0787391	0.35-1.20
				>23mm >0.9055091 in	4.0-7.5
J7381040031	Potted	10VDC		0-15mm ±1.5mm 0-0.5905494 in ±0.05905494 in	0.35-1.20
				>17.5mm >0.6889743 in	4.0-7.5
J7381040032	Potted	10VDC		0-10mm ±1mm 0-0.3936996 in ±0.03936996 in	0.35-1.20
				>12mm >0.4724395 in	4.0-7.5
J7381040033	Quick Disconnect	10VDC		0-10mm ±1mm 0-0.3936996 in ±0.03936996 in	0.35-1.20
				>11mm >0.4330696 in	4.0-7.5

3.2.3. LED6 Signal Driver Board Specifications

The ASTS USA LED6 Signal Driver Package (Part Numbers N177001-15 to -18) has been developed to drive the ASTS USA LED Signal System. It is used for controlling and protecting the ASTS USA LED signals.

CAUTION

The LED6 Signal Driver PCB is designed to vitally drive the ASTS USA LED signals and only those signals. It must not be used to drive incandescent signals or other non-ASTS USA LED signals. Although the LED6 Signal Driver PCB can connect to 6 LEDs it can illuminate only (3) 6" and (2) 8" LEDs at any given time.

The LED6 Signal Driver Board contains a high power conditional power supply (CPS) that requires a separate battery feed into the orange WAGO connector J1 on the rear of the OC. Two terminals are provided for each polarity of the battery input so that the input wires can be doubled to reduce the voltage drop. The high power CPS eliminates the need for a VCOR relay when the fail-over-to-red function is not required.

Table 3-15 presents the specifications for the LED6 board.

Table 3-15. LED6 PCB Functional Specifications

PARAMETER	VALUE
Battery Input Voltage Range	9.8 to 16.2VDC
Battery Leads to J1 pins 1-4	Minimum wire size #16 Maximum wire size #12 WAGO connector limitation Maximum length of #16 wire, 25 feet using 2 wires for B12 and 2 wires for N12.
Battery Input Power (3 LED signals on at same time)	84 watts maximum continuous 7 amps at 12 volts
Battery Input Fuse	15 amp slow-blow J7100380025
High Powered CPS Output Voltage	12.2VDC (Regulated when input battery is above 11 volts)
High Powered CPS Output Current	3.0 amps maximum from each output terminal on orange WAGO connector J1. Total 6.5 amps maximum.
High Powered CPS Output Power (3 LED signals on at same time)	80 watts maximum continuous.
Isolation Voltage	2000VAC between battery input and high powered CPS output
Efficiency	85% with output power at 80 watts.

WARNING

The isolation between the battery input and the high powered CPS output is safety critical. Do not connect the high powered CPS terminals on J1 pins 11 and 12 to the battery N12 terminals on J1 pins 3 and 4**.** Refer to Figure 3-23.

The LED6 PCB provides vital control of the signals, turning them on and off as needed, and monitors their health.

The LED6 Signal Driver PCB can also provide failed signal indication for the LED signals.

When the LED6 Signal Driver PCB is combined with ASTS USA LED's the system can provide True light-out Detection.

The LED6 PCB, part of the LED6 Signal Driver Package, provides six vital outputs to control the LED signals. These outputs are controlled by "high side" software-controlled switches, which connect and disconnect the output of the constant current regulators for the LED signals. The LED6 PCB performs diagnostic and light-out detection functions without the use of external "check pulses."

When used in combination with the LED6 PCB, an OFF-state ASTS USA LED signal will have a load voltage of approximately -2.5V. This voltage level is normal and is present because OFF-state diagnostics are being performed by the control system.

The diagnostic and light-out detection functions of the LED6 PCB do not use external "check pulses." For both ON and OFF state LED Signals, a "check pulse" will never be seen at the load.

The LED6 PCB will detect shorts between signals that cause an incorrect signal state. If the return leads (-) of any two or more signals are shorted together the system will not indicate an error, because this is a legal wiring option. If the controlled lead (+) of two or more signals are shorted together the system will not indicate an error if all of the signals are in the same state, all on or all off. If a wiring short causes an off-state signal to turn on then a critical error will occur and the OC system will reset.

3.2.3.1. Signal and Protection Board Wiring

The following is a list of wiring specific requirements/notes for the ASTS USA LED Signal System:

- Users must not connect additional loads, such as local indicators, across the signal leads of the LED signal.
- Fuses are not needed/recommended on the signal outputs; the ASTS USA constant current regulator output includes short-circuit protection, and no damage will occur to the system if an output is inadvertently shorted to ground. Fuses are built into the OC on both battery inputs, 10 amp on the system power supply input and 15 amp on the LED6 battery input. See Figure 3-1 through Figure 3-13 for fuse locations.

3.2.3.2. LED6 Board

Table 3-16 summarizes the expected measurements that can be observed on the LED6 Board that is functioning properly with a good LED Signal load. These measurements are taken with a meter at the signal output or with the OC Network Diagnostic Tool. Any readings outside of the stated ranges indicate a possible faulty system module.

Table 3-16. Valid LED6 Vital Output Readings

CONDITION	EXPECTED READING
Output ON	Voltage between 29V and 48V Current = 350 ma ±10%
Output OFF	Voltage less than 0V (negative) Current between -150 ma and 0 ma

3.2.3.3. LED Fault Detection (Light-Out)

The LED signal system follows the AREMA Guidelines for LED signals. The system repeatedly monitors the status signals connected to the LED6 board. On-state status signals are monitored for opens and short circuits between each signal's leads. Off-state status signals are monitored for continuity of the leads to the signal and short circuits between each signal's leads. Faulty "ON" or "OFF" state signals are detected in one second. Flashing signals can take up to two seconds to detect since the system is separately monitoring the "ON" and "OFF" states.

Once a signal has been determined to be faulty the OC system will log a warning and clear the faulty signal's .SIGNAL.GOOD application bit (0). The OC front panel LEDs (yellow) corresponding to the faulty signal will begin flashing. This flashing pattern is three quick on pulses followed by a longer off period. This distinguishes a faulty signal from a normally flashing signal. When any of the six LED6 outputs detects a faulty signal the green fault LED on the front panel will also turn on. This LED quickly draws the maintainer's attention to boards with faulty signals.

NOTE

Note that the SIGNAL.GOOD bit is set (1 state) when its attached signal is detected as good and clear (0 state) when its signal is detected as faulty. This is different from the MICROLOK II's LAMP16 board in that the LAMP16 board's LIGHT.OUT bit is set (1 state) when its attached signal is detected to be faulty.

Replacing a faulty signal will be automatically detected and the faulty condition cleared in five seconds except in the condition of a faulty "ON" signal.

Table 3-17. Fault Clearing Logic

OUTPUT STATE WHEN SIGNAL FAULT WAS DETECTED.	CURRENT OUTPUT STATE.	AFTER REPAIRING THE SIGNAL, THE FAULT WILL BE CLEARED BY:
ON	ON	Waiting 5 seconds or setting and clearing the .Retest.LED board application bit
ON	OFF	Setting and clearing the .Retest.LED board application bit*
OFF	ON	Waiting 5 seconds or setting and clearing the .Retest.LED board application bit
OFF	OFF	Waiting 5 seconds or setting and clearing the .Retest.LED board application bit

*By requiring the logic bit to be set, we are preventing a signal that has failed in the ON state and tests good in the OFF state, from being upgraded by the application logic. This may be done by assigning the LED6 board's Non-Vital input Application bit to the LED6 board's Retest Application bit.

Following AREMA guidelines, a signal that is detected as faulty in the "ON" state will continue to be considered faulty in the "OFF" state. This prevents an application from inadvertently flashing a signal when it downgrades a faulty "ON" signal. To clear the fault condition for a signal detected as faulty while in the "ON" state, the output either has to be turned on or the application logic must set and then clear the .Retest.LEDs board application bit. This is typically done by mapping the non-vital input for the LED6 board to the retest bit. Adding the following line to the LOGIC section of an application program will do this mapping.

ASSIGN NV.IN1 to LED6boardname.Retest.LEDs

NOTE

Note that **NV.IN1** in the above logic statement example is a user defined name for the non-vital input bit of the LED6 board. Refer to Section 15.2.4.5, Defining Board Type LED6 for more information on how to define an LED6 PCB in the application program.

With this line in the application, the non-vital input must be set for three seconds. Once recognized as being actuated, the OC will set the status of all signals connected to the LED6 Board to be good and begin retesting. One second later, all signals will be updated to their current status, good or faulty. When the non-vital input is set, an event will be logged. The OC must detect the non-vital input to be clear before the non-vital input is set again, so that the system will recognize that it needs to clear the signal's status and begin retesting. This will prevent the OC from continuously clearing the signals' status.

After a faulty signal has been replaced and recognized by the OC, an event will be logged and the .SIGNAL.GOOD bit for the signal will be set (1). If all signals connected to a LED6 board are good, the front panel green fault LED will be off.

3.2.3.4. Troubleshooting Notes

Field Testing Open Signal Detection

When field testing a system for detecting open signals, special attention should be made to how the open wiring condition is created. If the maintainer attempts to open a circuit by removing a ring terminal from a tall AAR stud, many makes and breaks will usually occur. This can cause the OC system to log "Shift Test" events and possibly a "Shift Test" Critical Error. This occurs because the signal's output is unstable during the LED6 Board circuit diagnostics. The maintainer can choose to ignore the logged events or break the circuit in a quicker manner.

Operation without Constant Current Source Connected

During the initial system installation it is necessary that all required constant current sources be powered and connected to the LED6 board. If there is an attempt to turn on a signal that is not connected to a constant current source, a Critical Error will be detected and the OC System will reset. The OC's System Event Log will record an undefined state error in the ON state.

3.2.4. Coded Input Board Specification

The Object Controller is able to detect a "coded state" for inputs that are coded at a rate of 50 to 75 cycles per minute in addition to steady-state "OFF" and "ON" states. In order to support the detection of a "coded state", three Application Program board types have been implemented, CODED.MIXIO, CODED.IN6.OUT6, and CODED.IN6. These boards will support a "FLASH" input state in addition to the existing "OFF" and "ON" states.

The exact code rate will not be detected. Detected code rates less than 45 cycles per minute but greater than 30 cycles per minute and code rates greater than 75 cycles per minute will cause the input to be declared "FAIL'ed" for the time period that the invalid code rate is detected. When the input is declared "FAIL'ed", a Warning will be logged in the Object Controller's System Event Log. If a Warning has been logged and the input has been detected as a valid code rate or a steady "OFF" or "ON" state, then an event will be logged declaring the input to be in a good state.

For each input bit defined for the CODED.MIXIO, CODED.IN6.OUT6, or CODED.IN6 board, a Flash bit will be created and made available to the Application Program. When the CODED.MIXIO, CODED.IN6.OUT6, or CODED.IN6 board detects a valid code rate, both the Input bit and the associated Flash bit will be set. When the CODED.MIXIO, CODED.IN6.OUT6, or CODED.IN6 board detects a steady "OFF" state, both bits will be clear. When the CODED.MIXIO, CODED.IN6.OUT6, or CODED.IN6 board detects a steady "ON" state, then only the Input bit will be set. For an Input bit to be detected as a steady "ON" input, the signal must be present for at least 1 second. For an Input bit to be detected as a steady "OFF" input, the signal must be cleared for at least 2 seconds. If the Input bit has been cleared, the Flash bit will also be cleared if it was set. If the input is coding at an invalid code rate, then a warning will be logged and both the Input bit and the associated Flash bit will be cleared, if they are currently set.

The definition for a CODED.MIXIO board looks the same as the MIXIO board:

```
BOARD: TheCodedMIXIO
ADJUSTABLE ENABLE: 1
TYPE: CODED.MIXIO
OUTPUT:BO.1,  BO.2,  BO.3,  BO.4;

INPUT:    CI.1,  CI.2,  CI.3,  CI.4;
      ADJUSTABLE ENABLE: 1;

NV.ANALOG.INPUT: AI.1;
      ADJUSTABLE ENABLE: 1;
      ADJUSTABLE MINIMUM.THRESHOLD: 12.2;  //0.0-30.0
```

```
    ADJUSTABLE MAXIMUM.THRESHOLD: 16.7;  //0.0-30.0

PROXIMITY.SENSOR.1:
    ADJUSTABLE ENABLE: 1;

PROXIMITY.SENSOR.2:
    ADJUSTABLE ENABLE: 1;
```

**Four additional system bits are created for this board type, CI.1.Flash, CI.2.Flash, CI.3.Flash, and CI.4.Flash.

The definition for a CODED.IN6.OUT6 board looks the same as the IN6.OUT6 board:

```
BOARD: TheCodedIn6Out6
ADJUSTABLE ENABLE: 1
TYPE: CODED.IN6.OUT6
OUTPUT:OUT.1,  OUT.2,  OUT.3,  OUT.4,  OUT.5,  OUT.6;

INPUT:    IN.1,  IN.2,  IN.3,  IN.4,  IN.5,  IN.6;
    ADJUSTABLE ENABLE: 1;
```

**Six additional system bits are created for this board type, IN.1.Flash, IN.2.Flash, IN.3.Flash, IN.4.Flash, IN.5.Flash, and IN.6.Flash.

The definition for a CODED.IN6 board looks the same as the IN6 board:

```
BOARD: TheCodedIn6

ADJUSTABLE ENABLE: 1
TYPE: CODED.IN6

INPUT:    IN6.1,  IN6.2,  IN6.3,  IN6.4,  IN6.5,  IN6.6;
    ADJUSTABLE ENABLE: 1;
```

**Six additional system bits are created for this board type, IN6.1.Flash, IN6.2.Flash, IN6.3.Flash, IN6.4.Flash, IN6.5.Flash, and IN6.6.Flash.

3.3. User Interface

The Serial Communication Controller (SCC) PCB has four user programmable LEDs on the front of the OC and provides status LEDs for each of the two communications ports.

There is a power status LED on the front of the OC (behind the US&S logo).

A health status LED is on the front of the OC.

A CPS LED is also on the front of the OC.

The LEDs on the front panel of the OC provide a status of the condition of the unit. The colors and functions of these LEDs are presented in Table 3-2 through Table 3-6.

4. CONFIGURE THE PC TO COMMUNICATE WITH THE OC

4.1. Minimum Requirements

The PC must have an Ethernet port. An Ethernet crossover cable is necessary for direct connection to the Object Controller, or a standard Ethernet cable for connection to a network or a hub.

The Network Diagnostic Tool requires, as a minimum:

- Internet Explorer (IE) Version 6.0 or higher.
- Java Run Time Environment Version 1.4.2 or higher.

4.2. Configuring Internet Explorer

To be able to use Internet Explorer to access the configuration functions of the OC, you may need to do one or both of the following:

- Delete the Temporary Internet Files saved by Internet Explorer
- Modify network settings to establish communications with the OC

4.2.1. Deleting Saved Temporary Internet Files

To ensure the PC is working with the latest version of software it is necessary to delete any files that Internet Explorer may have saved from earlier installations. Delete these saved files using the following procedure (these temporary files can be deleted without causing any problems).

1. Start Internet Explorer.

2. Select "**Tools**" > "**Internet Options**" (See Figure 4-1). The system will display the Internet Options dialog box (See Figure 4-2).

Figure 4-1. IE Ver 6 Tools Drop-Down Menu

3.Select the "**General**" tab.

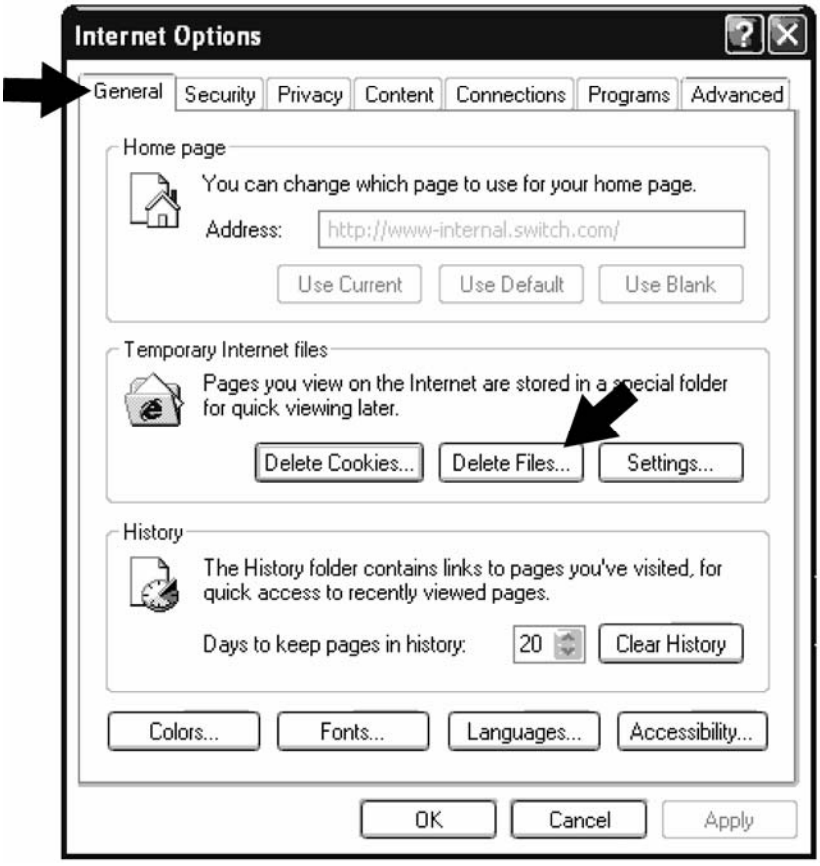


Figure 4-2. Internet Explorer Internet Options Dialog Box

4.Click on the "**Delete Files**" button in the Temporary Internet files area. In response the system will display a confirmation box asking if you want to delete the temporary Internet files (Figure 4-3).

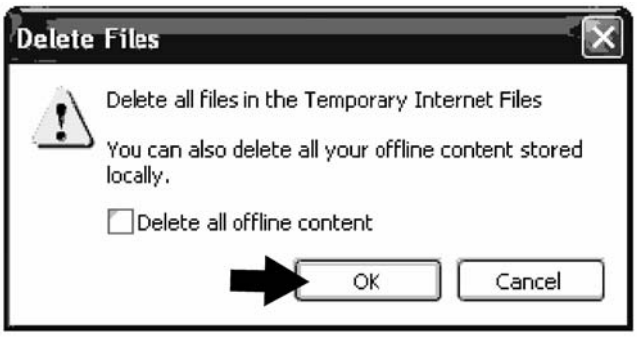

Delete Files
Delete all files in the Temporary Internet Files
You can also delete all your offline content stored locally.
Delete all offline content
OK
Cancel

Figure 4-3. Delete Files Confirmation Dialog Box

5.Click **OK**. The PC will then delete the temporary Internet files.

6.Click **OK** to close the Internet Options dialog box.

4.2.2. Modify Network Settings

Ensure that the Internet Explorer's Proxy setting allows for accessing the 169.254.* address range. To check Internet Explorer and to configure it, if necessary, do the following:

1.In the Internet Explorer "**Tools**" option click on "**Internet Options**" (See Figure 4-4).

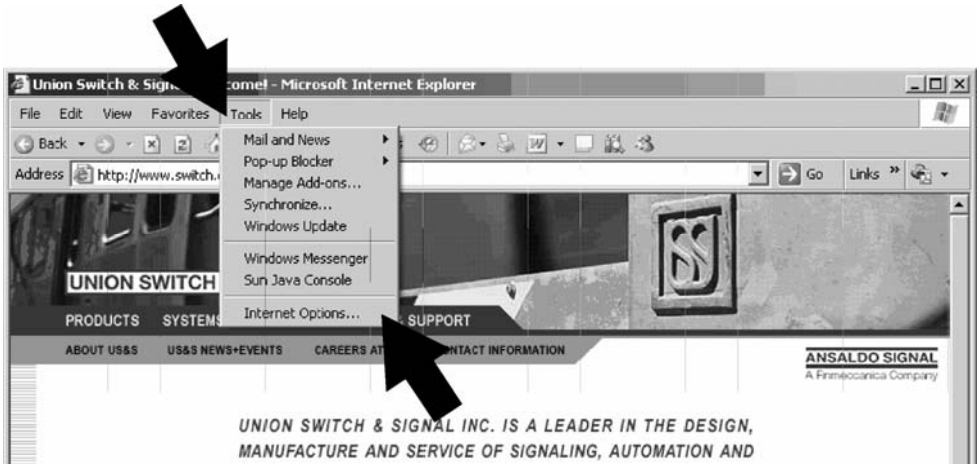


Figure 4-4. Tools Drop-Down Menu

2.In the Internet Options pop up box, click on the "**Connections**" tab. (See Figure 4-5).

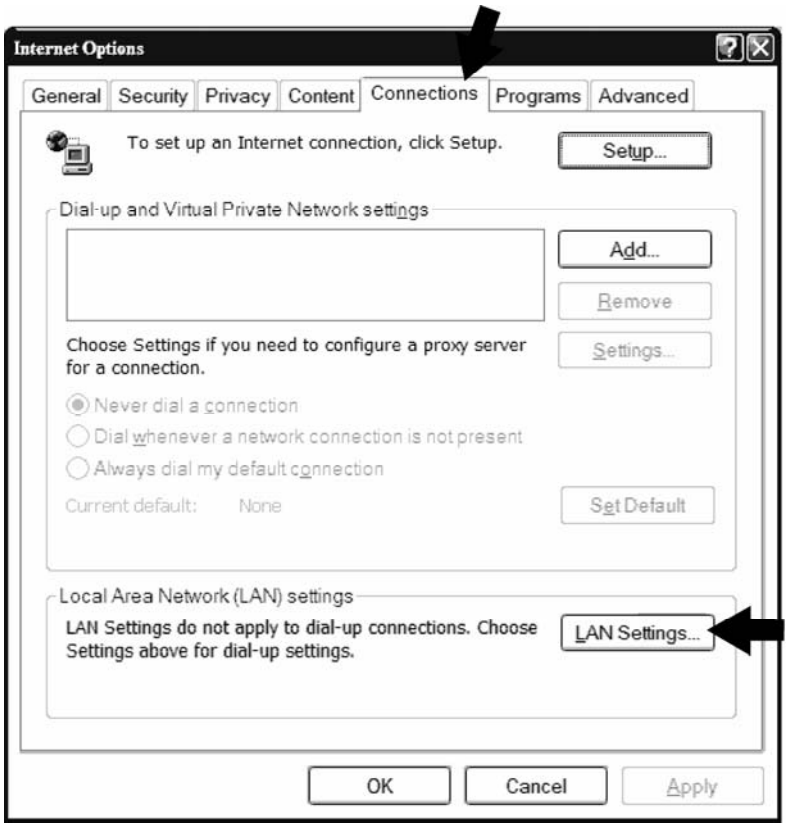


Figure 4-5. Connections Tab on the Internet Options Box

3.In the Connections tab, click on the "**LAN Settings**" button.

4.The LAN Settings pop-up box will open (Figure 4-6). If the "**Use a proxy server for your LAN**" is unchecked, leave it unchecked, and skip Steps 5 and 6. If the box is checked, proceed with Steps 5 and 6.

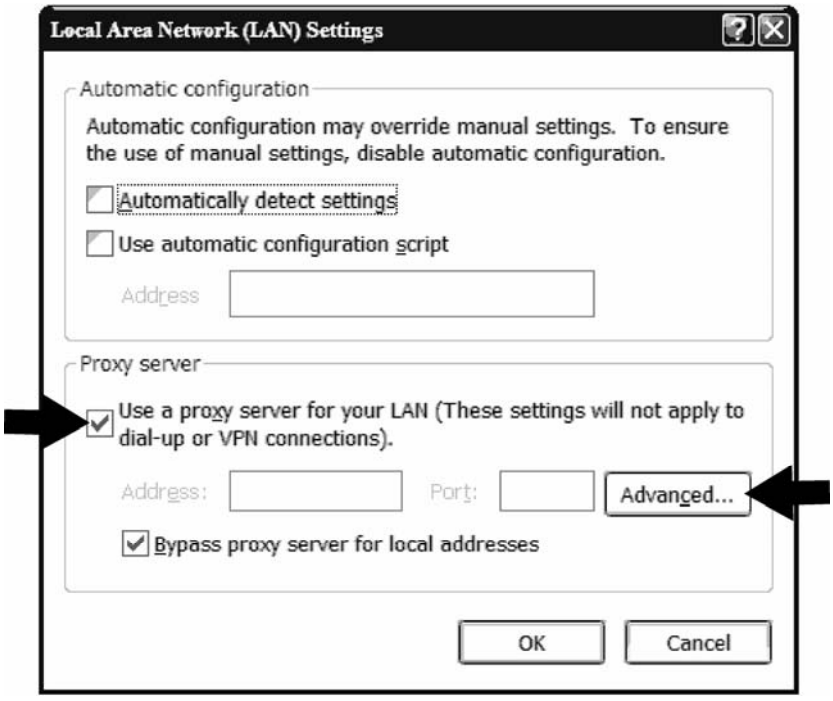

Local Area Network (LAN) Settings
Automatic configuration
Automatic configuration may override manual settings. To ensure the use of manual settings, disable automatic configuration.
Automatically detect settings
Use automatic configuration script
Address
Proxy server
Use a proxy server for your LAN (These settings will not apply to dial-up or VPN connections).
Address:
Port:
Advanced...
Bypass proxy server for local addresses
OK
Cancel

Figure 4-6. LAN Settings Pop-Up Box

5.Click on the "**Advanced**" button to open the Proxy Settings pop-up box.

6.In the Proxy Settings pop-up (Figure 4-7), type "**169.254.***" in the Exceptions text box.

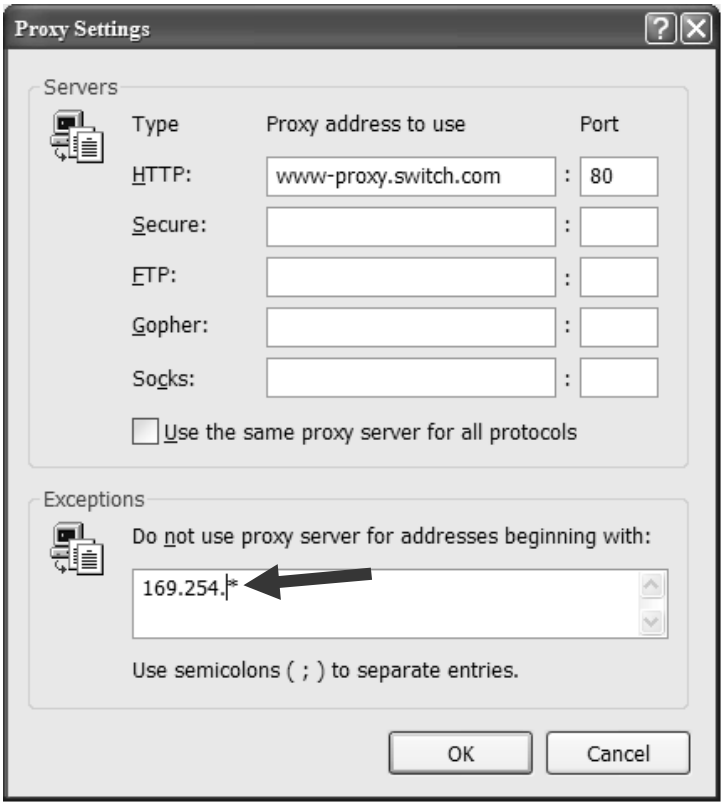


Figure 4-7. Proxy Settings Pop-Up Box

7.Click "**OK**" on all open pop-up boxes to close them.

8.Re-start IE for the changes to take effect. Internet Explorer is now ready to access the OC.

4.3. Apply Power to the Object Controller

In the event the OC blue power LED does not come on as expected, turn the unit off and verify that all of the cables and power cord are securely connected. Turn the power on and verify the LED is working.

If it does not energize, replace the unit and return it to the factory.

4.4. Connecting the PC to the Object Controller

A PC can be directly connected to the Object Controller with a crossover Ethernet cable, or by using an Ethernet hub or switch using a straight Ethernet cable.

CAUTION

Connect to only one Ethernet port on the Object Controller at a time until all of the ports have been configured.

The PC will go into the limited connectivity mode if a cross-over Ethernet cable is connected from the PC directly into the Ethernet port on the Object Controller. This can be observed by positioning the cursor over the network icon (two PC monitors) found in the lower right hand corner of the task bar of the PC (See Figure 4-8). When it is in this limited connectivity mode, the PC will have an IP address in the 169.254.*.* range, where * can be any value from 0 to 255.

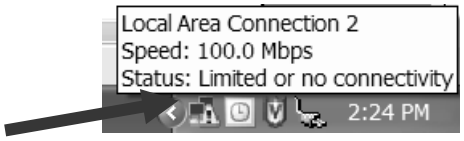


Figure 4-8. Connectivity Mode Indication

5. OBJECT CONTROLLER CONFIGURATION/SETUP

The OC can be configured/programmed to suit several different applications.

The Digi communication ports must be assigned a unique address for identification. This requires a change to the default "Network Interface Adapter Configuration File" (niacfg.ini).

Additional software changes may be required such as: executive revisions, application software required for site specific application, and diagnostic software for troubleshooting.

5.1. Configuring Tools for the OC

Every OC comes pre-loaded with default software and addressed ports.

To make modifications to the OC the following is required:

- Network Diagnostic Tool – N800306-0001.
  This contains the application port configuration file, event file, Java file for the web tool, nia configuration file, and an image file.
- The Java Runtime Environment 1.4.2.
- SM-9494, ASTS USA OC Service Manual.
- Power calculator.
- Object Controller Development System Tool (compiler) – N800302-0001.

These items are contained on a CD (N800307-0001) packaged with the OC.

5.2. Network Interface Adapters

There are up to three Network Adapters on the OC. They serve two distinct functions:

- Application Port Routing
  This function is used on the Ethernet Ports marked COM1 and COM2 (See Figure 1-6). These ports transport Peer protocol messages to/from the OC.
- WebTool
  The Ethernet Port marked "WebTool" is for accessing the Diagnostic functions available on the OC. When you connect to this Ethernet Port with Internet Explorer, you can open up the Network Diagnostic Tool. This accesses a program stored on it and provides a tool for accessing the Diagnostics features of the OC.

5.3. Configuring the Object Controller Ethernet Ports

All three ports on the Object Controller are initially set to IP address 169.254.1.10. To use the Ethernet ports on the Object Controller, the IP address of each port must be set to a unique value when used within a network. Use the procedure in the following sections to perform this function.

NOTE

If you do not know the IP address of a port the preferred method of obtaining it is to use the Digi Device Discovery tool (See Section 6).

5.4. Accessing the OC's Network Adapter

To access the Network Adapter, use Internet Explorer and enter the IP address of the Ethernet Port. For example, the unit ships with an IP address of 169.254.1.10. In this case, in the Internet Explorer browser address bar, type http://169.254.1.10/

It will prompt for a username/password for the NA-HTTP AWS Realm.

Table 5-1 lists the usernames and passwords to access the WebTool.

Table 5-1. Username/Password for Net Adapter/WebTool

USERNAME	PASSWORD	USE
webtools	uss1	Normal usage (using the Network Diagnostic Tool)
advanced	objctl	Perform maintenance, upload files

Please see Section 5.3. Configuring the OC Ethernet Ports for instructions on setting up the Network Adapters for the first time.

See Section 6 for instructions on downloading a program that can find the IP addresses of the Network Adapters on the network (for installing or replacing an OC that was previously programmed and the address is unknown).

5.5. Configuring niacfg.ini, Network Adapter Configuration File

CAUTION

Modification of the niacfg.ini file must only be performed by experienced users. There is no error checking on this procedure and **ANY** errors in this process **WILL** render the OC unusable.

To only change a port IP address refer to Section 6 for details.

With Internet Explorer, open page http://169.254.1.10 (Figure 5-1). The resulting site (Figure 5-2), prompts you for a username and password for Realm: NA-HTTP AWS Realm.

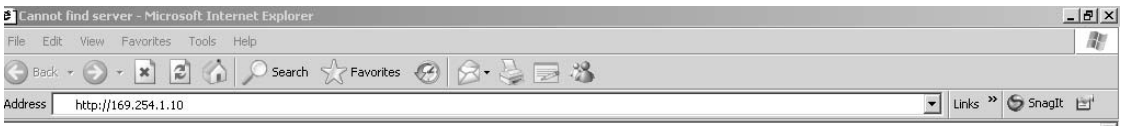

Cannot find server - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://169.254.1.10
Links SnagIt

Figure 5-1. Internet Explorer Site 169.254.1.10

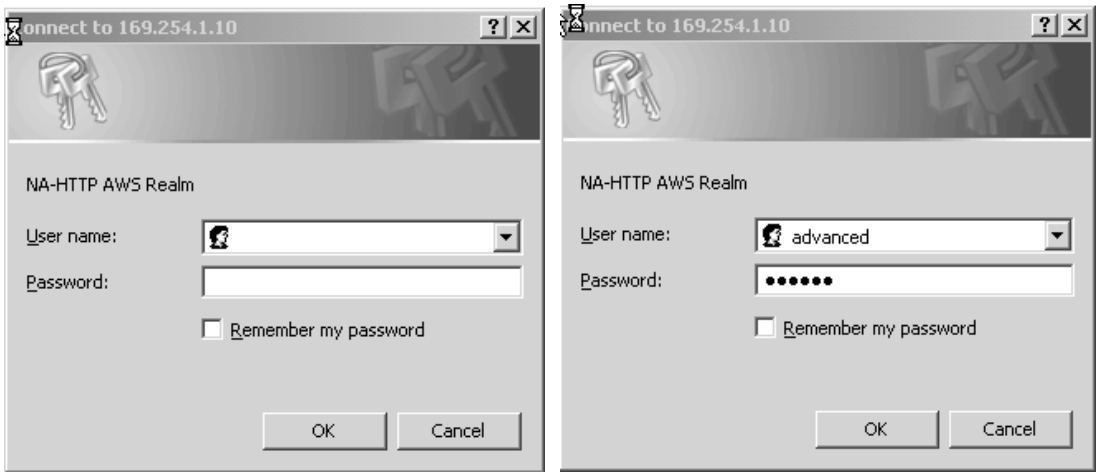


Figure 5-2. NA-HTTP AWS Realm Logon Dialog Box

Enter **advanced** for the username, and **objctl** for the password.

5.6. Main Web Page

The main web page of the Network Adapter shows basic information. It shows the part number of the unit "Net Adapter/WebTools – N800306-0001." The line after that is the version number and the version-specific part number. After that, it shows network information: MAC Address, IP Address, Subnet Mask, and Gateway.

The other buttons and the Network Adapter Advanced Options link are described in the next two sections.

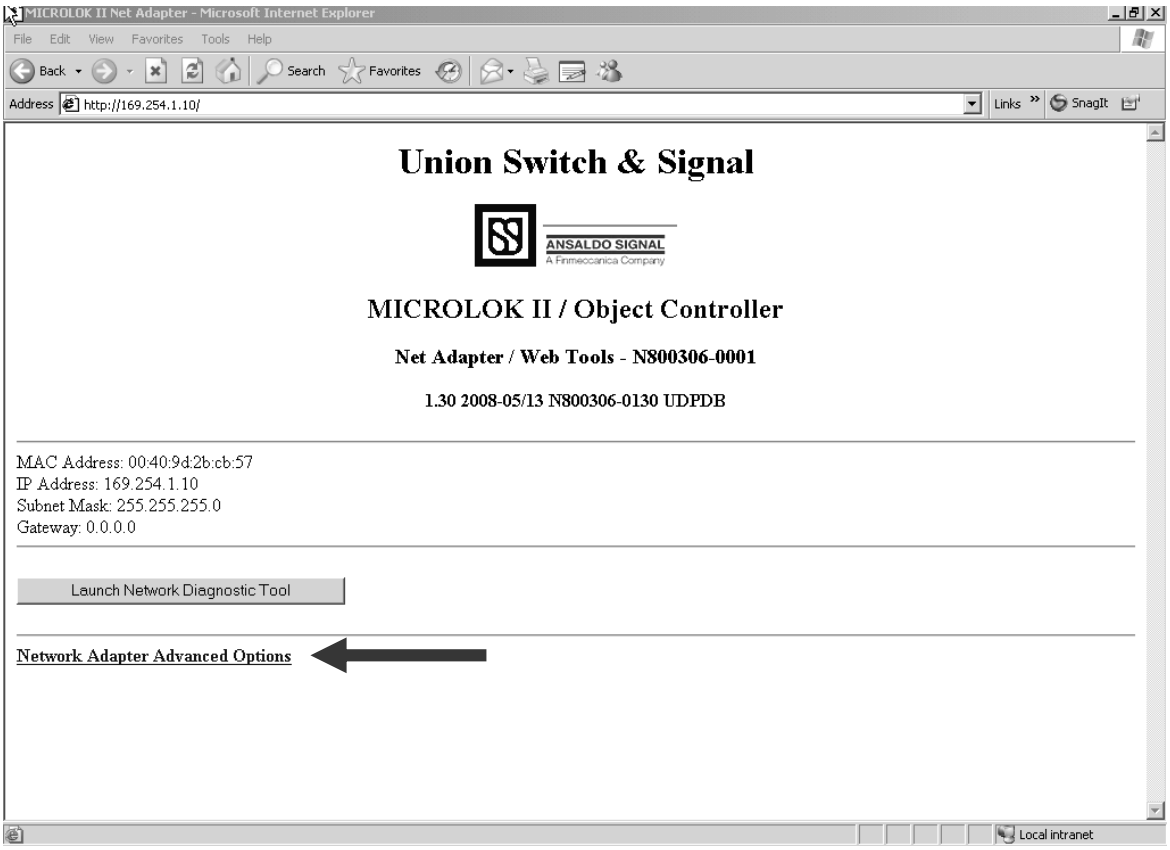


Figure 5-3. MICROLOK Object Controller Net Adapter/WebTools

Click on the **Network Adapter Advanced Options** link, to move to the screen shown in Figure 5-4.

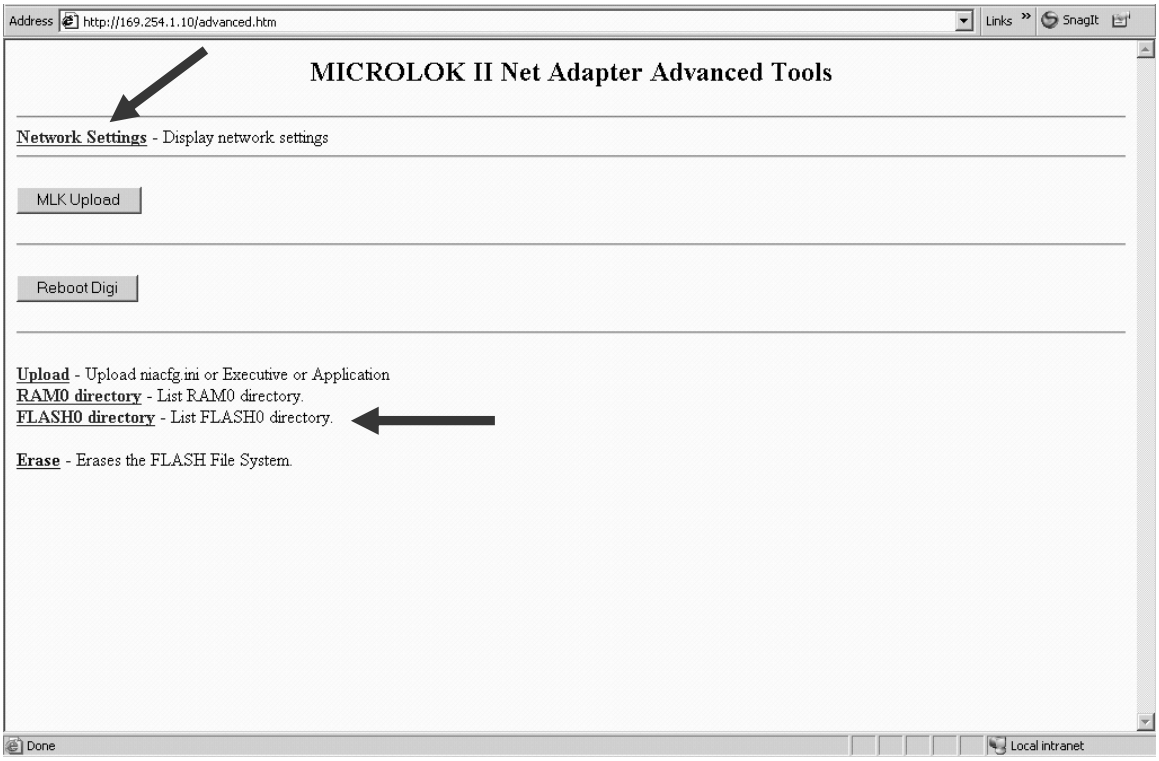


Figure 5-4. Net Adapter Advanced Tools Screen

Click on **Network Settings** to view the OC's current settings (See Figure 5-5).

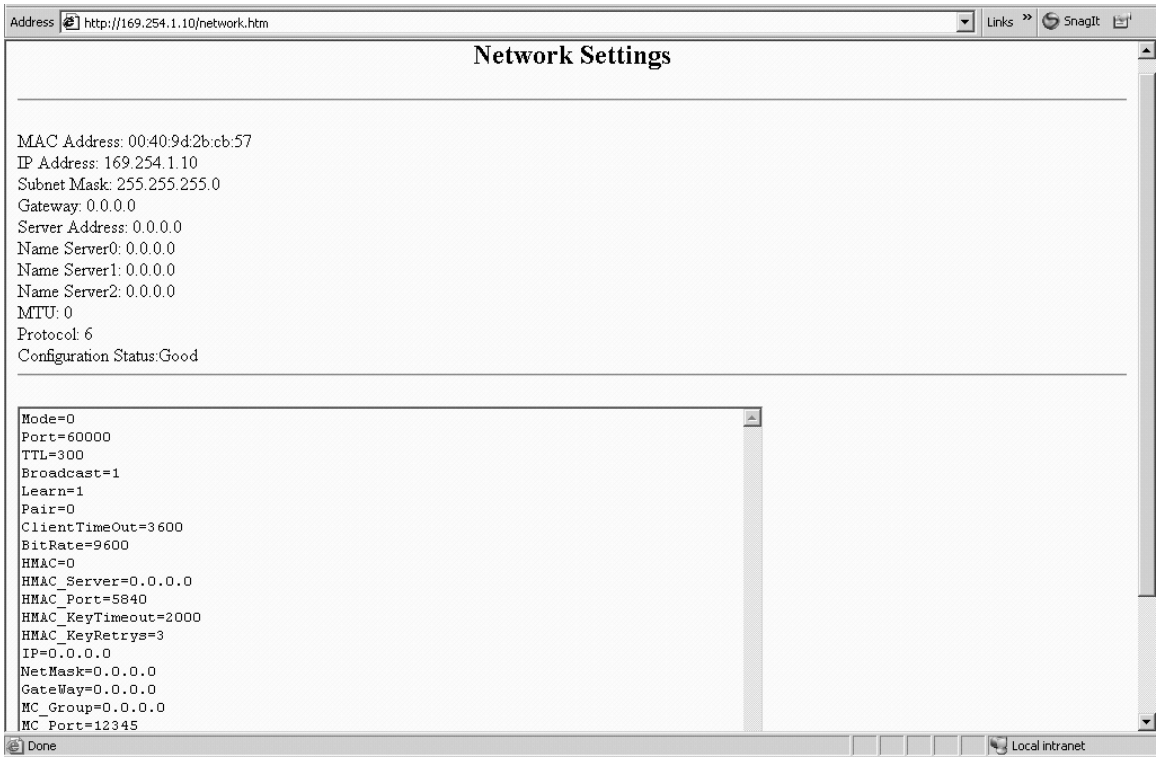
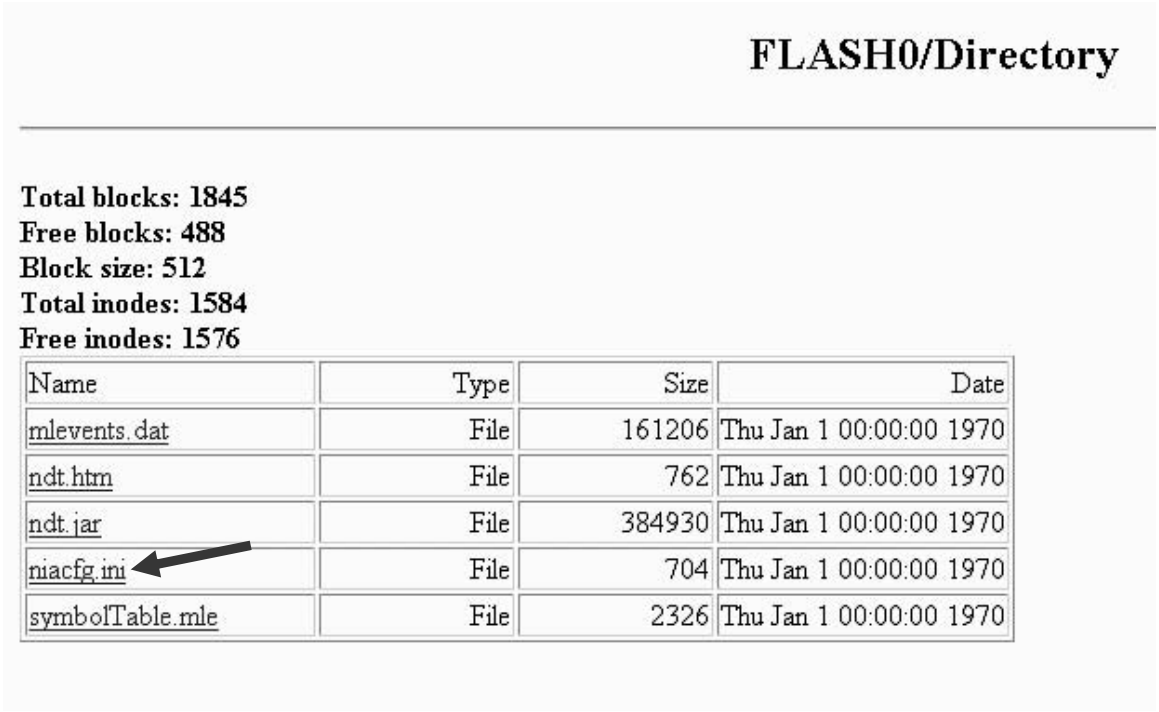


Figure 5-5. OC Network Settings

To change more settings than just the IP address; the niacfg.ini file must be edited.

On the MICROLOK II Net Adapter Advanced Tools screen (Figure 5-4) click on **FLASH0/ directory** link.

Several files will appear on the screen as shown in Figure 5-6.



FLASH0/Directory

Total blocks: 1845
Free blocks: 488
Block size: 512
Total inodes: 1584
Free inodes: 1576

Name	Type	Size	Date
mlevents.dat	File	161206	Thu Jan 1 00:00:00 1970
ndt.htm	File	762	Thu Jan 1 00:00:00 1970
ndt.jar	File	384930	Thu Jan 1 00:00:00 1970
niacfg.ini	File	704	Thu Jan 1 00:00:00 1970
symbolTable.mle	File	2326	Thu Jan 1 00:00:00 1970

Figure 5-6. FLASH0/ Directory

Left-click on **niacfg.ini** to save it to the PC (See Figure 5-7). Typically the file can be saved to the PC desktop for ease of access.

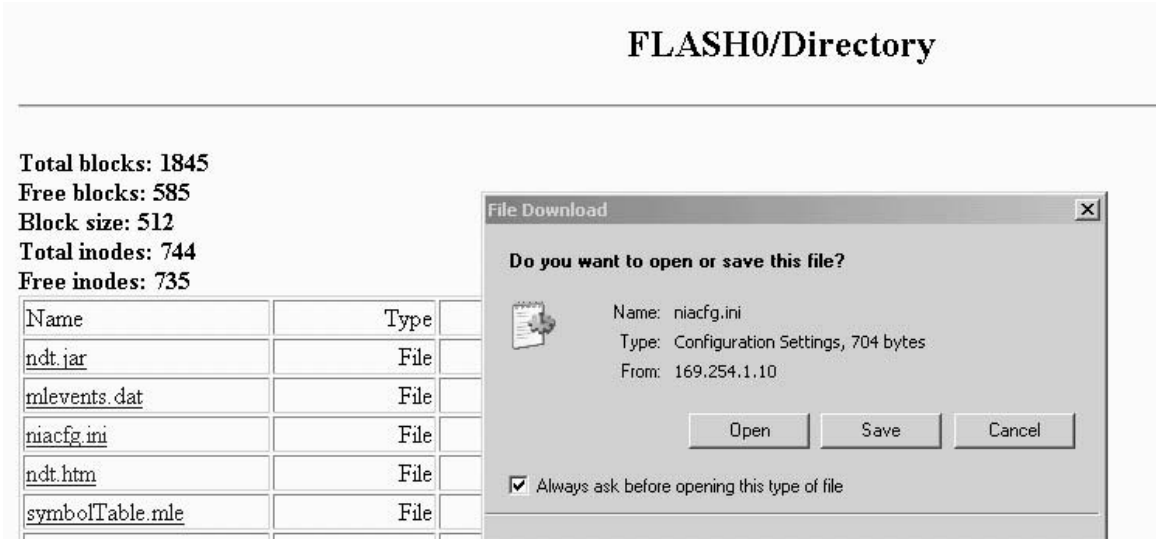


Figure 5-7. Saving niacfg.ini

Once saved the file can be opened in an application such as Notepad and viewed (See Figure 5-8).

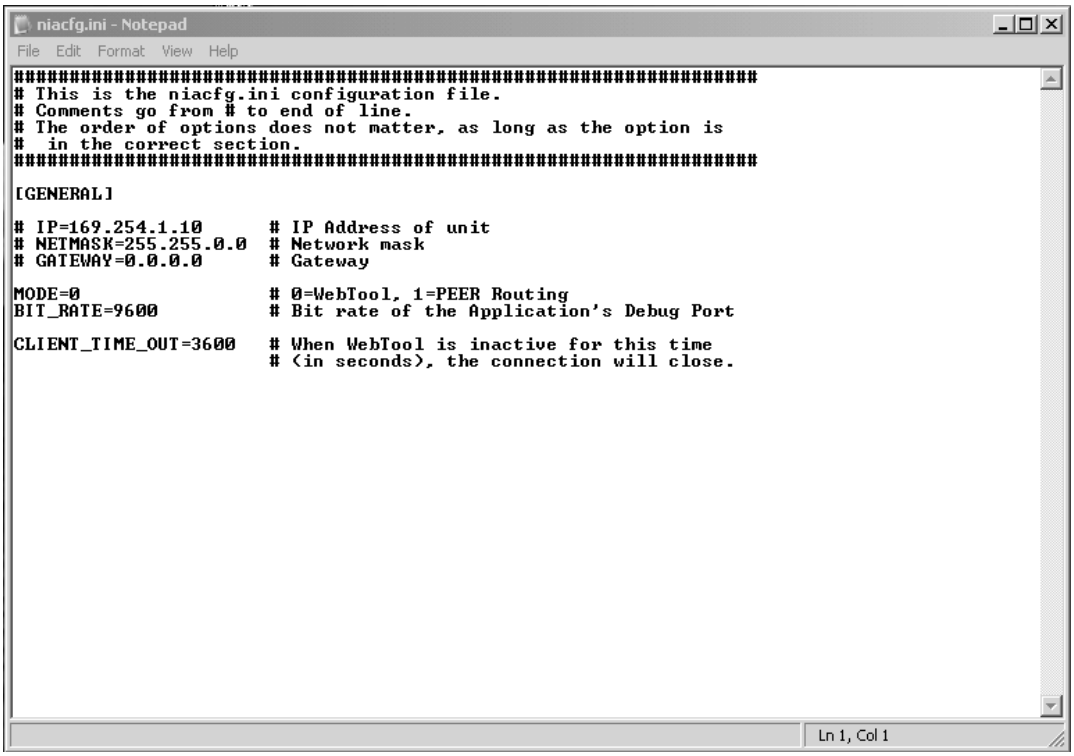

niacfg.ini - Notepad
File Edit Format View Help
This is the niacfg.ini configuration file.
Comments go from # to end of line.
The order of options does not matter, as long as the option is
in the correct section.
[GENERAL]
# IP=169.254.1.10 # IP Address of unit
# NETMASK=255.255.0.0 # Network mask
# GATEWAY=0.0.0.0 # Gateway
MODE=0 # 0=WebTool, 1=PEER Routing
BIT_RATE=9600 # Bit rate of the Application's Debug Port
CLIENT_TIME_OUT=3600 # When WebTool is inactive for this time
# (in seconds), the connection will close.
Ln 1, Col 1

Figure 5-8. WebTool niacfg.ini File

Figure 5-8 shows a typical WebTool port niacfg.ini file.

Usually when installing a new OC the only change necessary for a WebTool port is an IP address change.

COM ports may require additional changes. A typical COM port niacfg.ini file is shown in Section 5.6.1.

5.6.1. Typical niacfg.ini Com Port File

```
##########################################################################
# This is the niacfg.ini configuration file.
# Comments go from # to end of line.
# The order of options does not matter, as long as the option is
#  in the correct section.
##########################################################################
[GENERAL]

# IP=169.254.1.10      # IP Address of unit
# NETMASK=255.255.0.0  # Network mask
# GATEWAY=0.0.0.0      # Gateway

MODE=1              # 0=WebTool, 1=PEER Routing, 2=MultiCast
BIT_RATE=38400      # Bit rate



##########################################################################
# PEER Routing Options
##########################################################################

PORT=60000     # UDP Port unit accepts messages on
BROADCAST=1    # Allow unit to send broadcasts
```

```
LEARN=1        # Allow unit to "learn" addresses sent by other units

TTL=300        # Time to Live for dynamic entry (in seconds)

PAIR=1         # 0=Use only Peer address for routing logic

               # 1=Use Peer and station addresses for routing logic



[UDP]


#########################################################################

# Addresses are specified in the application as decimal.

# Addresses are specified in this niacfg.ini file as hexadecimal.

#

# Examples:

# Application / niacfg.ini

# Address 101  = 0065

# Address 202  = 00CA

#

# The format of entries in this section are as follows:

# <target ip address>:<target ip port>=<MLK PEER address list>

#

# The <MLK PEER address list> is a comma separated list of addresses

# *** NO SPACES ARE ALLOWED IN THE LIST ***

#

# A mix of MII and ATCS addressing schemes is OK

# Example:

#  192.168.1.2:60000=002B,0022,34AAAA78,43AAAA78

#
```

```
# if PAIR=1, then the pair must be present
# Example:
#  192.168.1.16:60000=00CA:0065    # PAIR=1 format
##########################################################################


##########################################################################
# MII_PEER1 (Port 1)
# Destination IP address 192.168.1.16, which hosts MLK Address 202
# 192.168.1.10:60000=00CA
##########################################################################


[TCP]


##########################################################################
# This section is similar to UDP.  The difference is each
#  connection has its own host port number.
#
# The format of entries in this section are as follows:
# <host ip port>:<target ip address>:<target ip port>=<MLK PEER address list>
#
# Example:
#
# 60001:192.168.1.10:60000=00CA
# 60002:192.168.1.11:60010=0002
##########################################################################
```

```
[HMAC]

#########################################################################
# HMAC adds a message authentication protocol ontop of the PEER
# protocol.  A Key Server is required for this function to work.
# When HMAC is enabled, all messages are sent encapsulated with
# the HMAC protocol.
#
# HMAC=0           # 0=HMAC disabled, 1=HMAC enabled
# SERVER=0.0.0.0    # HMAC Key Server IP address
# PORT=5840         # HMAC Key Server IP port
# KEY.TIMEOUT=2000  # Time in seconds between HMAC Key heartbeat messages
# KEY.RETRYS=3      # Number of missed heartbeats before key is declared invalid
#########################################################################

[MULTICAST]

#########################################################################
# MULTICAST mode (MODE=2) is selected to transport the CLASSC.EMP protocol.
# Uncomment the following 2 lines to set the required MultiCast IP address
# and PORT for CLASSC.EMP messages.
#
# MULTICAST.GROUP=239.255.0.5
# MULTICAST.PORT=32768
#########################################################################
```

5.6.2. Modify niacfg.ini with the New Settings

The IP settings are specified in this file (See Figure 5-8). They must be uncommented, and the proper values entered.

CAUTION

Extreme care should be exercised in making any changes to the niacfg.ini file. ANY error in this file will make the Digi inoperative, and render the unit useless.

NOTE

The recommended procedure for changing an IP address is through the use of the Digi Discovery Utility (Refer to Section 6).

This tool will automatically detect an addressable active port.

When reviewing the file on your PC the following should be noted:

- The WEB port should not need to be modified except for address, if connected to a network.
- Mode=1 is set to PEER.
- UDP is the default for connectivity.
- The application ports (COM1 and COM2 – See Figure 1-6) will require an address change and the mode should remain at "1" and the bit rate may need to be changed per communications connection device.

For further operations refer to Section 8.

5.6.3. Upload niacfg.ini to the Object Controller

With Internet Explorer, open page http://169.254.1.10. The site will prompt you for a username and password for Realm: NA-HTTP AWS Realm (See Figure 5-2). Enter **advanced** for the username, and **objctl** for the password.

Click on the **Network Adapter Advanced Options** link (See Figure 5-3), then click on the **Upload** link (Figure 5-9). Select **FLASH0/** as the directory to upload to, then click on **Browse** (See Figure 5-10) and select the modified niacfg.ini file.

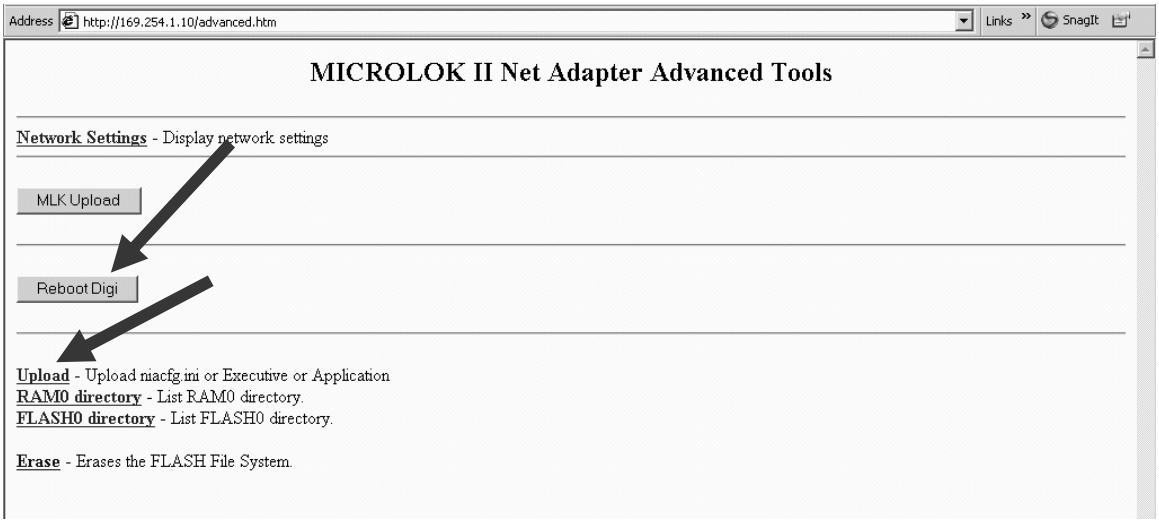

Address http://169.254.1.10/advanced.htm
Links
SnagIt
MICROLOK II Net Adapter Advanced Tools
Network Settings - Display network settings
MLK Upload
Reboot Digi
Upload - Upload niacfg.ini or Executive or Application
RAM0 directory - List RAM0 directory.
FLASH0 directory - List FLASH0 directory.
Erase - Erases the FLASH File System.

Figure 5-9. MLK Upload Link

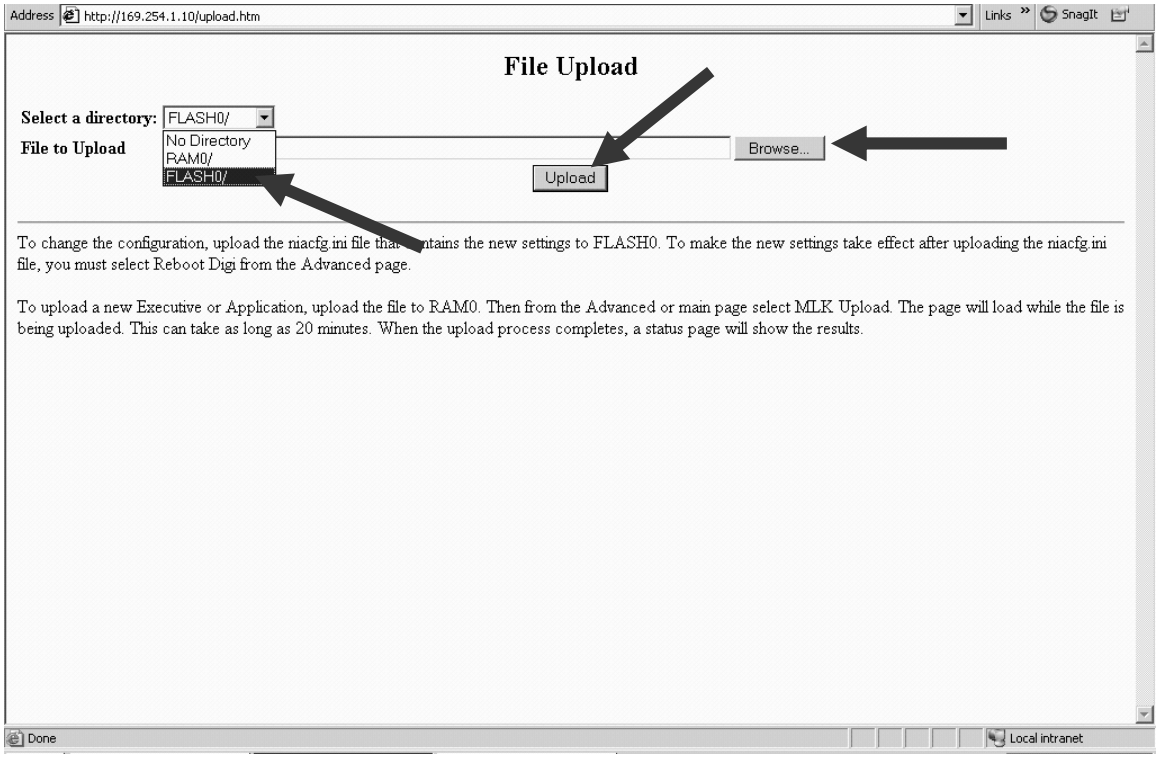

Address http://169.254.1.10/upload.htm
Links
SnagIt
File Upload
Select a directory:
FLASH0/
File to Upload
No Directory
RAM0/
FLASH0/
Browse...
Upload
To change the configuration, upload the niacfg.ini file that contains the new settings to FLASH0. To make the new settings take effect after uploading the niacfg.ini file, you must select Reboot Digi from the Advanced page.
To upload a new Executive or Application, upload the file to RAM0. Then from the Advanced or main page select MLK Upload. The page will load while the file is being uploaded. This can take as long as 20 minutes. When the upload process completes, a status page will show the results.
Done
Local intranet

Figure 5-10. Upload Link

Click on the **Upload** button. File upload progress is indicated by the bar shown in Figure 5-11. This will update the configuration file on the Ethernet port.

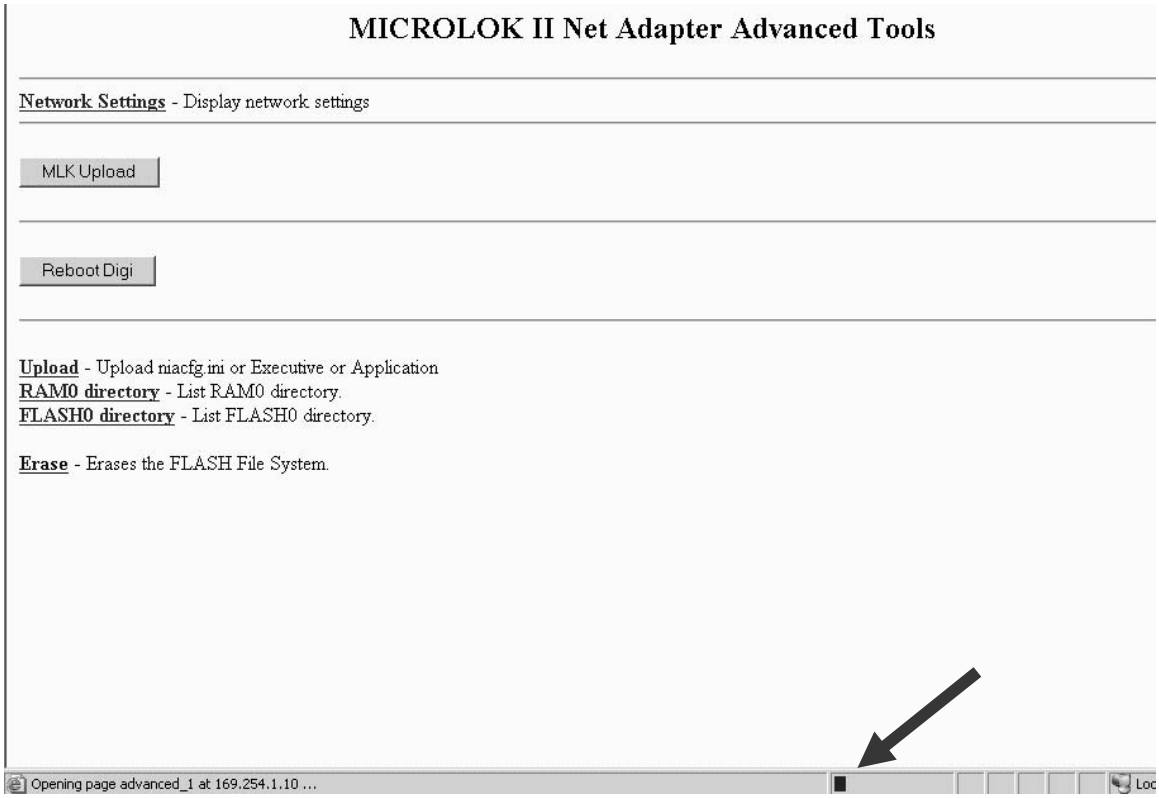
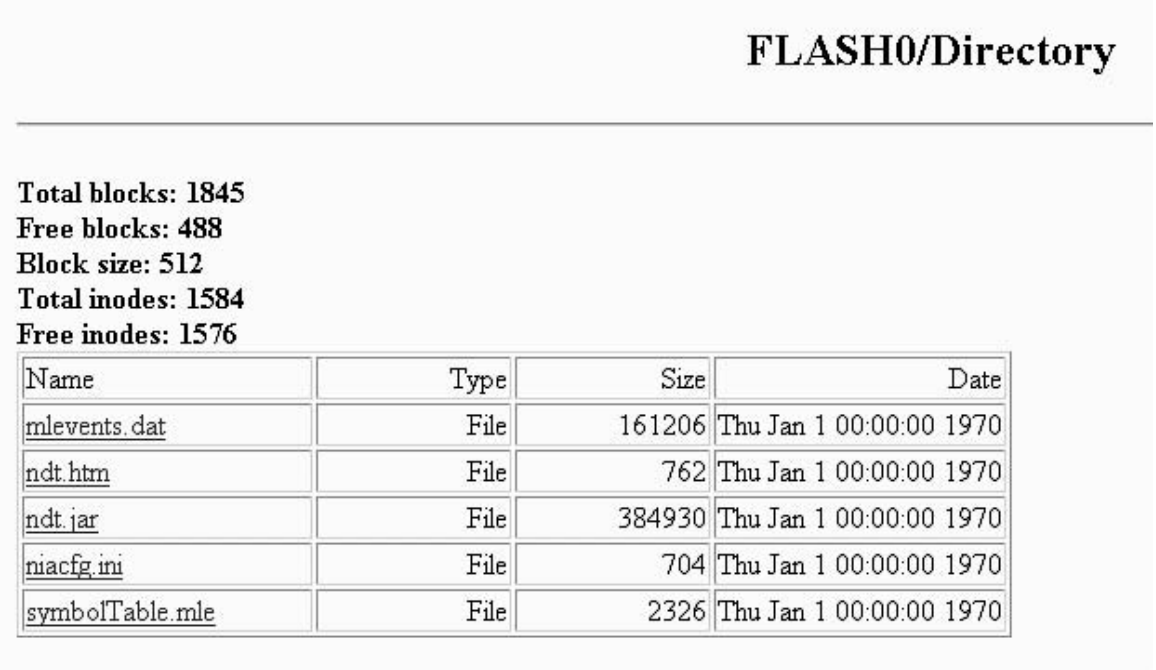

MICROLOK II Net Adapter Advanced Tools
Network Settings - Display network settings
MLK Upload
Reboot Digi
Upload - Upload niacfg.ini or Executive or Application
RAM0 directory - List RAM0 directory.
FLASH0 directory - List FLASH0 directory.
Erase - Erases the FLASH File System.
Opening page advanced_1 at 169.254.1.10 ...

Figure 5-11. File Upload Progress Bar

When it is finished, it will go to a file listing page (See Figure 5-12). Click the **Back** button twice to go back to the Advanced Tools page.



FLASH0/Directory

Total blocks: 1845
Free blocks: 488
Block size: 512
Total inodes: 1584
Free inodes: 1576

Name	Type	Size	Date
mlevents.dat	File	161206	Thu Jan 1 00:00:00 1970
ndt.htm	File	762	Thu Jan 1 00:00:00 1970
ndt.jar	File	384930	Thu Jan 1 00:00:00 1970
niacfg.ini	File	704	Thu Jan 1 00:00:00 1970
symbolTable.mle	File	2326	Thu Jan 1 00:00:00 1970

Figure 5-12. FLASH0/ Directory

The new settings won't take effect until the Ethernet port has been rebooted. To do this, click on the **Reboot Digi** button (See Figure 5-9).

The Ethernet port will take approximately one minute to reboot. During boot the green LED on the Digi will light.

After the Ethernet port has been reset, the green LED on the Digi will go out and the yellow LED will light steady. The port now has the new IP settings.

5.7. Network Adapter Advanced Options

5.7.1. PEER Routing Statistics

This shows statistics between the Digi and the OC (Serial data) for the PEER Routing. When everything is well, the only statistics should be Messages read from COM. When the BIT_RATE (the baud) is set wrong, other statistics get accumulated.

5.8. Problems with the Digi

5.8.1. Uploading New Digi Firmware

CAUTION

There is no way to recover if the Firmware is corrupted. It is strongly recommended that before uploading new Digi Firmware, the Flash File System should be erased. Refer to Section 8.4 on how to erase the Flash File System.

1. Open a command window. From the Start menu go to **Run** and type "**cmd**" and press enter.

2. Navigate from the command window to the directory containing the new image.bin file. To navigate use the "cd" (change directory) command (i.e., "cd Program Files" to go to the program files directory). A user may view all files and folders in the current directory by typing "dir."

3. Once the user is at the proper directory, ftp the firmware by typing in "ftp IP_ADDRESS" where IP_ADDRESS is the IP address of the Digi.

4. Login as "(none)," be sure to include the '('and')' characters.

5. Type "bin."

6. Type "put image.bin."

7. When the transfer is complete, the user will see a successful message in the command window. The user may type "quit" to close the command window.

8. The unit will program itself and reboot in ten seconds. The green LED on the Digi will turn on while the Digi is booting. When the Digi has completed the boot process, the green LED will turn off, and the yellow LED will flicker for a moment. The Digi will be fully operational about ten seconds after the yellow LED turns on again.

5.9. Changing Network Settings

Modify file niacfg.ini in the [GENERAL] section:
[GENERAL]
IP=192.168.1.10
NETMASK=255.255.0.0
GATEWAY=192.168.1.1

DHCP is not supported.

6. ACQUIRING THE IP ADDRESS OF AN OC ETHERNET PORT

If it should become necessary to acquire the IP address of an OC Ethernet port that is not known, the Digi Device Discovery Utility can be used. This utility can be downloaded using the following procedure.

1. Go to www.digi.com

2. Click on the SUPPORT tab, and select "**Diagnostics, Utilities and MIBs**" from the pull-down menu.

3. From the "Select Your Product for Support" pull-down menu, choose "**Digi Connect ME**" and click "**SUBMIT**".

4. From the "**OS Specific Diagnostics, Utilities and MIBs**" pull-down menu, choose your operating system, (typically Microsoft Windows XP).

5. Download the executable utility, "**Device Discovery Utility for Windows**" by right-clicking on it and choosing "**Save Target As …**"

Figure 6-1. Digi Device Discovery Utility Icon

The tool installation places and icon on the desktop (Figure 6-1), which when clicked opens the screen shown in Figure 6-2.

6.1. Changing a Port IP Address with the Digi Device Discovery Tool

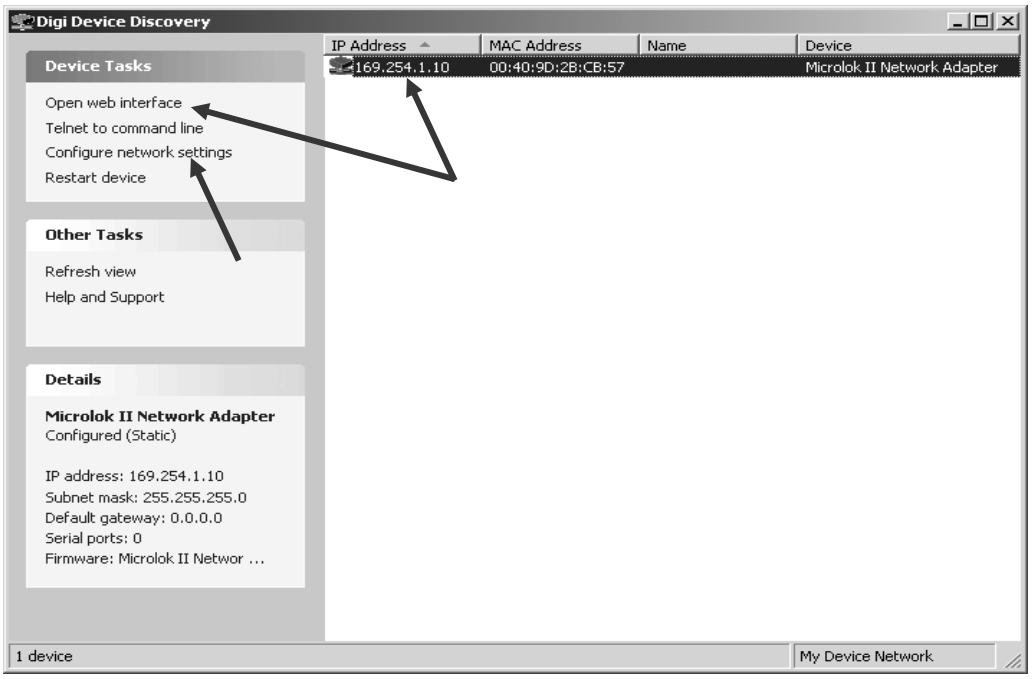


Figure 6-2. Digi Device Discovery Main Screen

NOTE

Double-click on the highlighted IP Address or click on "Open web interface" to open the Net Adapter/WebTools utility.

The Digi Device Discovery tool allows the port address to be changed without having to download/upload the niacfg.ini file, and eliminates the associated risks of corrupting the niacfg.ini file.

Click on "Configure Network Settings." The Configure Network Settings dialog box opens (Figure 6-3) and the new IP address is entered.

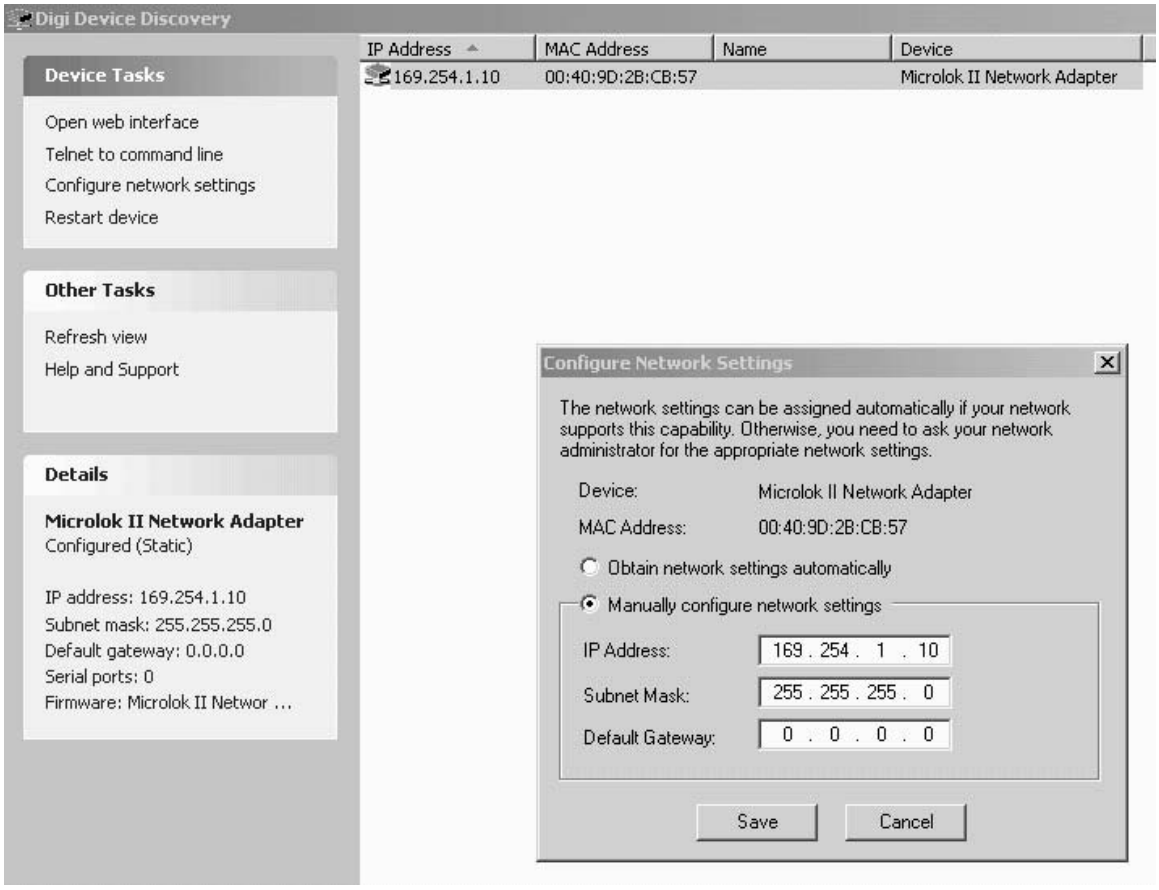


Figure 6-3. Configure Network Settings Dialog Box

Once the new IP address is entered, click "Save" and the Password dialog box opens (Figure 6-4).

An incorrect entry results in an error dialog box shown in Figure 6-5. If this is the case click "OK" and re-enter a valid IP address.

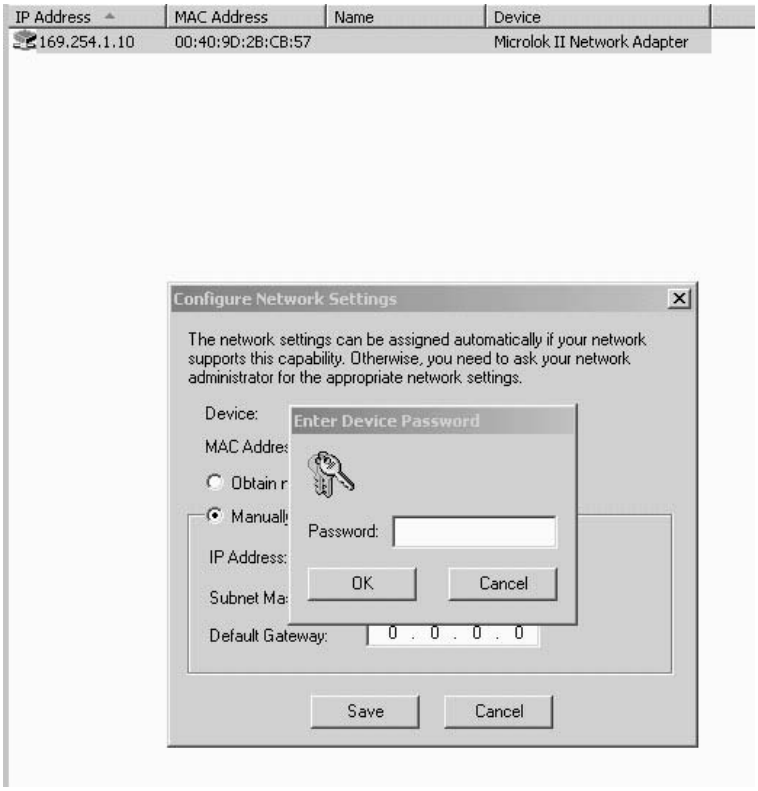


Figure 6-4. Device Password Dialog Box

A case sensitive password, **USSRoot,** is required to save the new IP address. Type the password and click "OK."

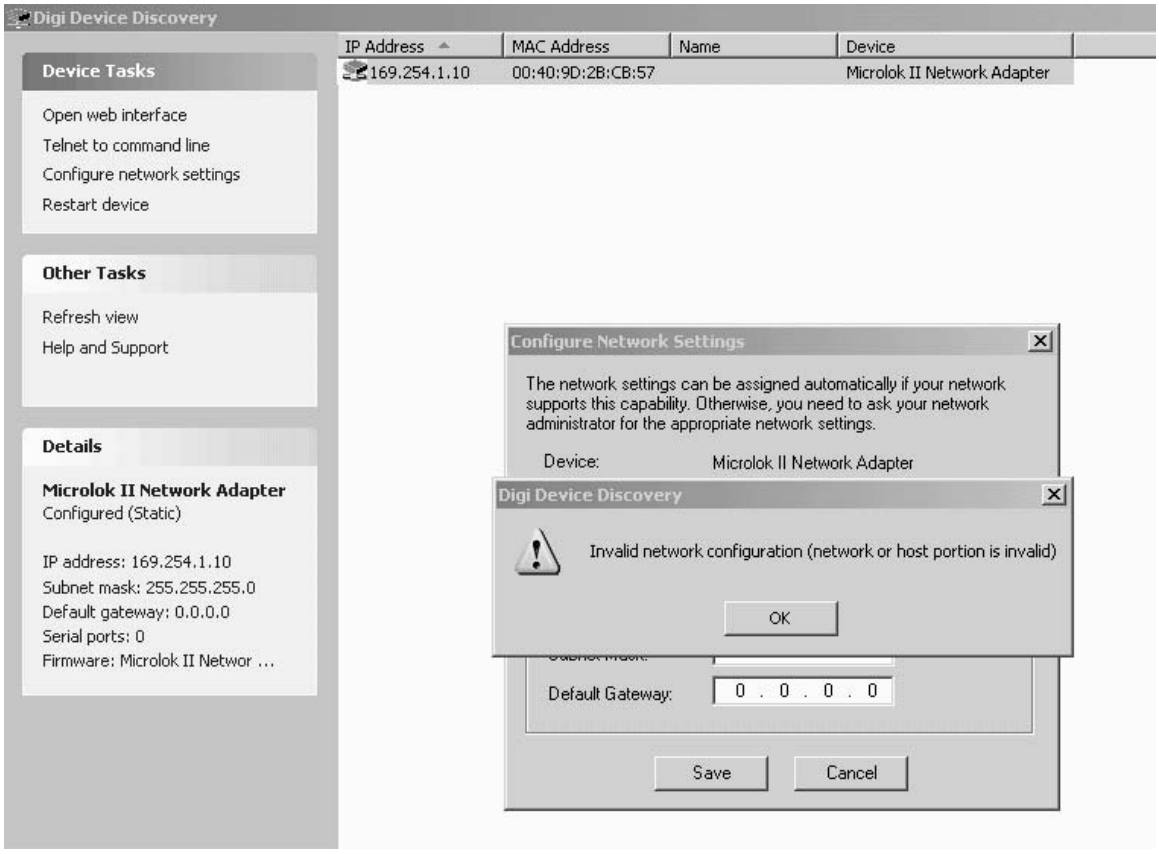


Figure 6-5. Error Dialog Box

If changes other than setting an IP address are to be made, then the niacfg.ini file must be modified by a qualified user. See Section 5.5 for further details.

6.2. Accessing the Network Diagnostic Tool

Left-click on "Open web interface" or right-click on the IP Address selected to open the network diagnostic tool (See Figure 6-6).

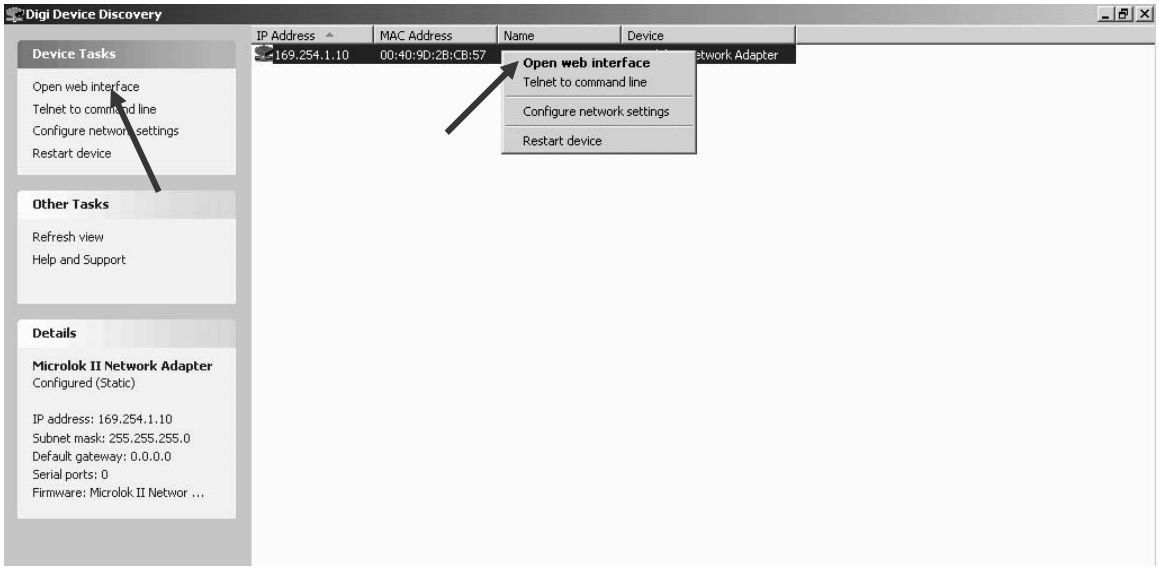


Figure 6-6. Open Web Interface from Digi Device Discovery Tool

7. UPLOADING A MICROLOK OC EXECUTIVE OR APPLICATION

This section describes the process of uploading software to the OC (PC to OC).

NOTE

The RAM0/ directory is used for uploading OC Executive and Application software. Once the software is uploaded to the OC, the directory is empty.

The FLASH0/ directory contains files running on the Digi (server), that are accessed by the OC's CPU during normal operation.

1. From the Advanced Tools page (See Figure 7-1) click on "Upload."

Address http://169.254.1.10/advanced.htm
Go
Links
Google
Bookmarks
51 blocked
Check
Settings
MICROLOK II Net Adapter Advanced Tools
PEER Routing Statistics - COM statistics (used to ensure the Net Adapter is communicating with the Object Controller)
Network Settings - Display network settings
MLK Upload
Reboot Digi
Upload - Upload niacfg.ini or Executive or Application
RAM0 directory - List RAM0 directory.
FLASH0 directory - List FLASH0 directory.
Erase - Erases the FLASH File System.
Internet

Figure 7-1. Advanced Tools Page

2. Select RAM0/ from the "Select a directory" drop-down menu (Figure 7-2).

CAUTION

By default this screen (Figure 7-2), on opening, displays FLASH0/ in the directory box. Ensure that RAM0/ is selected, before uploading an application, or the application will be loaded into FLASH0/ where it has no use, and will simply consume available memory space on the Digi.

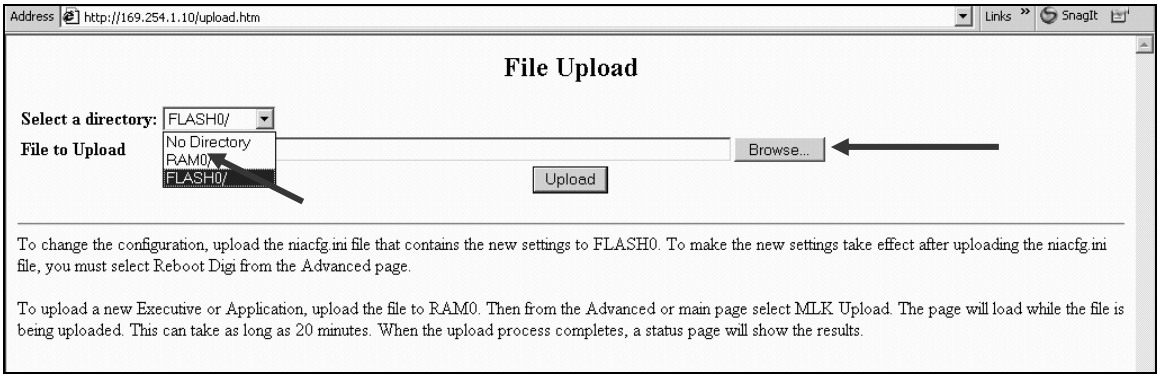

Address
http://169.254.1.10/upload.htm
Links
SnagIt
File Upload
Select a directory:
FLASH0/
File to Upload
No Directory
RAM0/
FLASH0/
Browse...
Upload
To change the configuration, upload the niacfg.ini file that contains the new settings to FLASH0. To make the new settings take effect after uploading the niacfg.ini file, you must select Reboot Digi from the Advanced page.
To upload a new Executive or Application, upload the file to RAM0. Then from the Advanced or main page select MLK Upload. The page will load while the file is being uploaded. This can take as long as 20 minutes. When the upload process completes, a status page will show the results.

Figure 7-2. File Upload Page

3. Click Browse and select the Executive (*.sr) or Application (*.mlp) to upload (Figure 7-3).

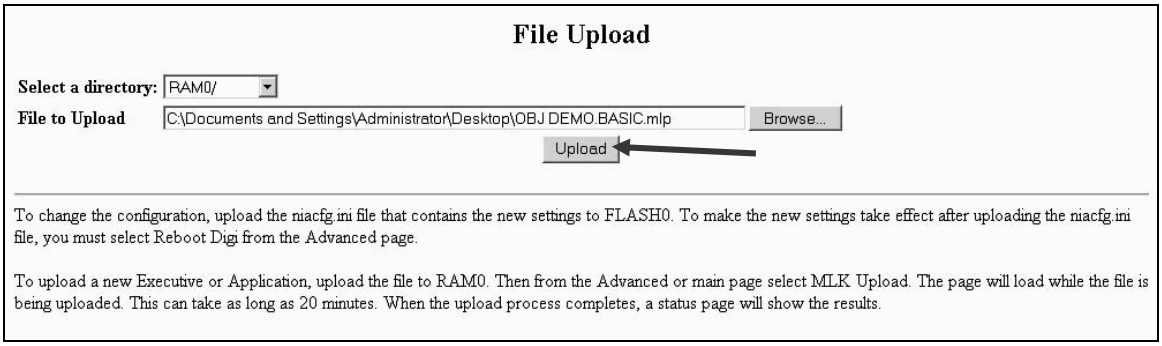

File Upload
Select a directory:
RAM0/
File to Upload
C:\Documents and Settings\Administrator\Desktop\OBJ DEMO.BASIC.mlp
Browse...
Upload
To change the configuration, upload the niacfg.ini file that contains the new settings to FLASH0. To make the new settings take effect after uploading the niacfg.ini file, you must select Reboot Digi from the Advanced page.
To upload a new Executive or Application, upload the file to RAM0. Then from the Advanced or main page select MLK Upload. The page will load while the file is being uploaded. This can take as long as 20 minutes. When the upload process completes, a status page will show the results.

Figure 7-3. File Upload

4. Click Upload. The RAM0/ directory will display the uploaded file (See Figure 7-4).

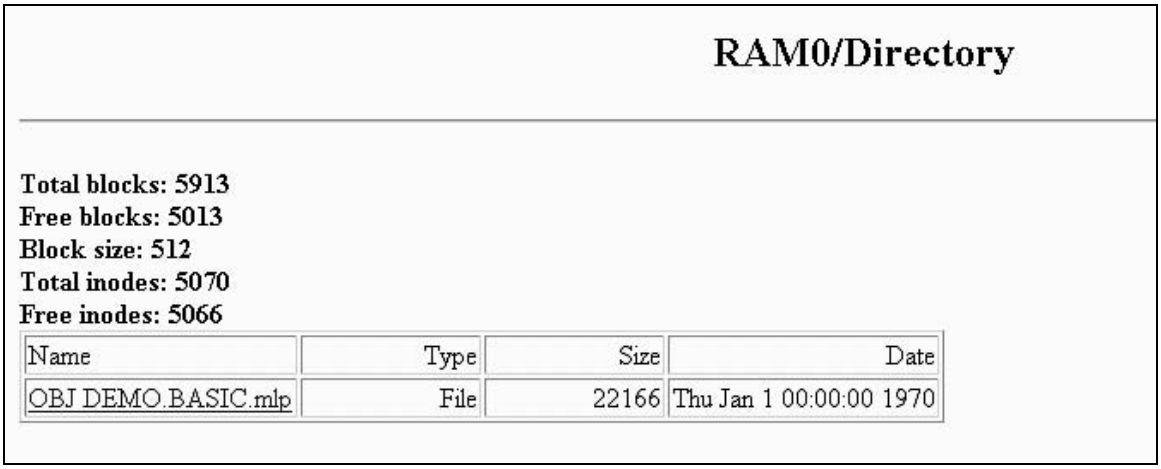


Figure 7-4. RAM0/ Directory Screen

5. Follow the same procedure to upload other files to RAM0/.

6. When all files have been uploaded to RAM0/ on the Digi, go back to the Advanced Tools page (See Figure 7-1).

NOTE

Uploading the Executive/Application from the PC to the Digi will not execute the files. Uploading merely places the file(s) into the Digi's RAM0/. The MICROLOK UPLOAD button moves the file(s) from the Digi's RAM0/ to the processor where the file(s) will be executed.

7. Click on the "MLK Upload" button (See Figure 7-5).

8. The progress bar shows the status of the upload

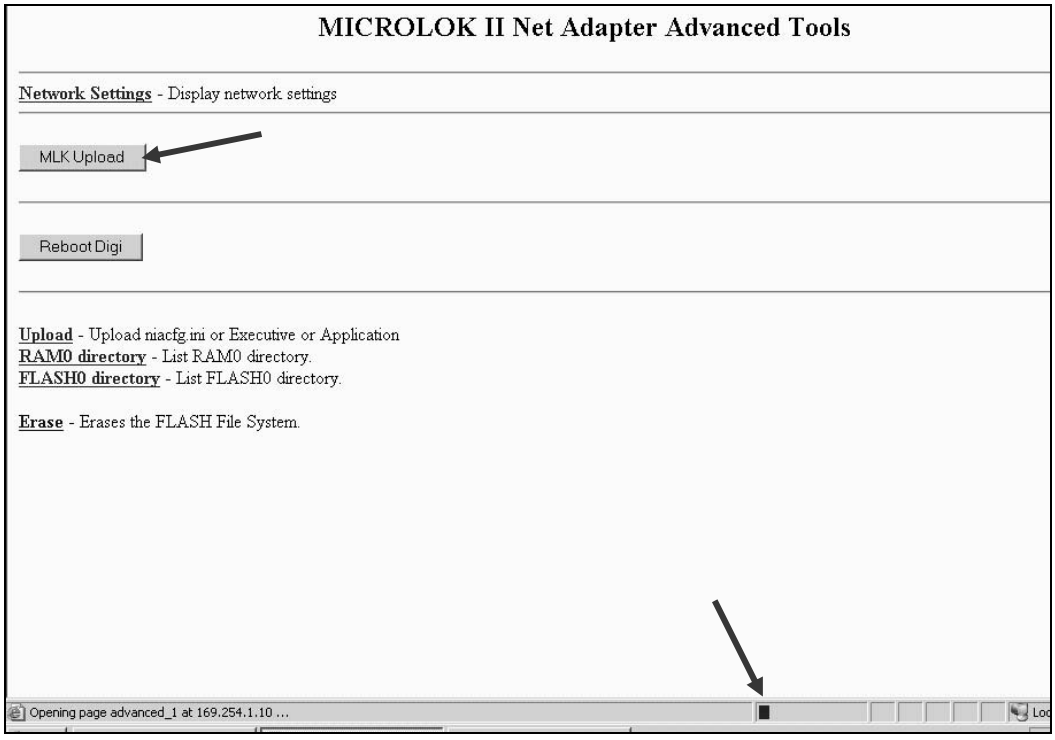

MICROLOK II Net Adapter Advanced Tools
Network Settings - Display network settings
MLK Upload
Reboot Digi
Upload - Upload niacfg.ini or Executive or Application
RAM0 directory - List RAM0 directory.
FLASH0 directory - List FLASH0 directory.
Erase - Erases the FLASH File System.
Opening page advanced_1 at 169.254.1.10 ...

Figure 7-5. Upload Progress Bar

9. Wait while the OC CPU is re-flashed.

10. When the process completes, a status page (See Figure 7-6) will give a summary of whether the process was successful or not.

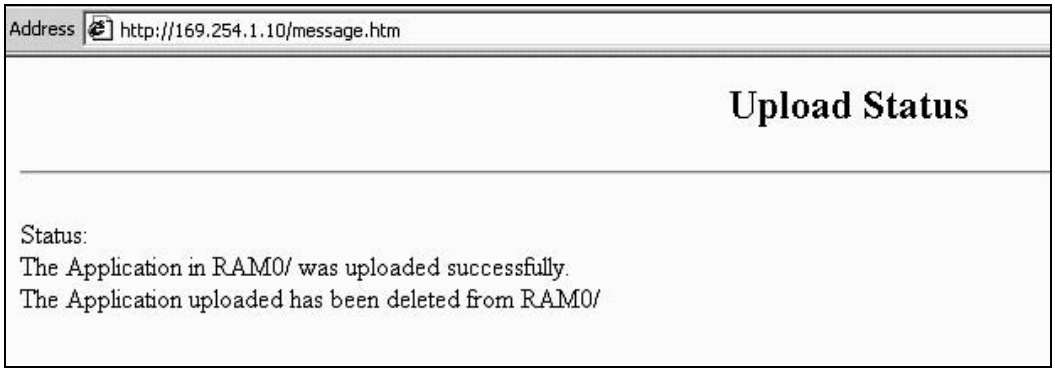

Address http://169.254.1.10/message.htm
Upload Status
Status:
The Application in RAM0/ was uploaded successfully.
The Application uploaded has been deleted from RAM0/

Figure 7-6. Upload Status Page

8. NETWORK ADAPTER CONFIGURATION (NIACFG.INI)

The OC has two niacfg.ini files. One is for the WebTool port and the other is for the COM ports. Each file is stored in the respective Digi FLASH0/ memory, and is accessed by the OC's CPU as needed.

CAUTION

The niacfg.ini file is not error checked. If the user's modified niacfg.ini file contains errors, the Ethernet port will not operate.

The niacfg.ini file stores all the configuration parameters for the Network Adapters. It defines how the Ethernet port will operate. The network settings are specified in this file.

This file is a standard .ini format. Major sections are denoted within brackets []. Comments are started by a #, and continue to the end of the line. The order of the options doesn't matter, but each option has to be within its correct section. For example, BIT_RATE can't show up in the [UDP] section; it must be in the [GENERAL] section. Samples of the Factory WebTool and Factory Application Ports niacfg.ini files are shown below.

CAUTION

When setting the BAUD for the Application Ports, or DEBUG_PORT_BAUDRATE for the Web Tool port, be sure to also adjust the BIT_RATE in the Network Interface configuration (niacfg.ini) file for that port.

8.1. Factory WebTool niacfg.ini file

```
#########################################################################
# This is the niacfg.ini configuration file.
# Comments go from # to end of line.
# The order of options does not matter, as long as the option is
#  in the correct section.
#########################################################################

[GENERAL]

# IP=169.254.1.10      # IP Address of unit
# NETMASK=255.255.0.0  # Network mask
# GATEWAY=0.0.0.0      # Gateway
```

```
MODE=0              # 0=WebTool, 1=PEER Routing
BIT_RATE=9600       # Bit rate of the Application's Debug Port

CLIENT_TIME_OUT=360    # When WebTool is inactive for this time
                # (in seconds), the connection will close.
```

8.2. Factory Application Port niacfg.ini file

```
#########################################################################
# This is the niacfg.ini configuration file.
# Comments go from # to end of line.
# The order of options does not matter, as long as the option is
#  in the correct section.
#########################################################################


[GENERAL]

# IP=169.254.1.10      # IP Address of unit
# NETMASK=255.255.0.0  # Network mask
# GATEWAY=0.0.0.0      # Gateway

MODE=1              # 0=WebTool, 1=PEER Routing
BIT_RATE=38400      # Bit rate of the Application Port


PORT=60000     # UDP Port unit accepts messages on
BROADCAST=1    # Allow unit to send broadcasts
LEARN=1        # Allow unit to "learn" addresses sent by other units
TTL=300        # Time to Live for dynamic entry (in seconds)
PAIR=1         # 0=Use only Peer address for routing logic
            # 1=Use Peer and station addresses for routing logic

[UDP]

#########################################################################
# Addresses are specified in the application as decimal.
# Addresses are specified in this niacfg.ini file as hexadecimal.
#
# Examples:
# Application / niacfg.ini
```

```
# Address 101  = 0065
# Address 202  = 00CA
#
# The format of entries in this section are as follows:
# <target ip address>:<target ip port>=<MLK PEER address list>
#
# The <MLK PEER address list> is a comma separated list of addresses
# *** NO SPACES ARE ALLOWED IN THE LIST ***
#
# A mix of MII and ATCS addressing schemes is OK
# Example:
#  192.168.1.2:60000=002B,0022,34AAAA78,43AAAA78
#
# if PAIR=1, then the pair must be present
# Example:
#  192.168.1.16:60000=00CA:0065    # PAIR=1 format
##########################################################################


##########################################################################
# MII_PEER1 (Port 1)
# Destination IP address 192.168.1.16, which hosts MLK Address 202
# 192.168.1.10:60000=00CA
##########################################################################


[TCP]

##########################################################################
# This section is similar to UDP. The difference is each
#  connection has its own host port number.
#
# The format of entries in this section are as follows:
# <host ip port>:<target ip address>:<target ip port>=<MLK PEER address list>
#
# Example:
#
# 60001:192.168.1.10:60000=00CA
# 60002:192.168.1.11:60010=0002
##########################################################################


[HMAC]

##########################################################################
```

```
# HMAC adds a message authentication protocol on top of the PEER
# protocol. A Key Server is required for this function to work.
# When HMAC is enabled, all messages are sent encapsulated with
# the HMAC protocol.
#
# HMAC=0          # 0=HMAC disabled, 1=HMAC enabled
# SERVER=0.0.0.0    # HMAC Key Server IP address
# PORT=5840         # HMAC Key Server IP port
# KEY.TIMEOUT=2000  # Time in seconds between HMAC Key heartbeat messages
# KEY.RETRYS=3      # Number of missed heartbeats before key is declared invalid
##########################################################################
```

8.3. General Options

The defaults are listed with each option. Example, MODE=0, the default is the WebTool mode.

MODE=0

- 0=WebTool mode
- 1=PEER Routing mode

BIT_RATE=9600
This sets the baud rate that the Digi uses to communicate with the OC. Both modes use this option.

IP=169.254.1.10
The IP Address of the Digi port.

NETMASK=255.255.0.0
The Netmask of the Digi port.

GATEWAY=0.0.0.0
The Gateway of the Digi port.

8.3.1. Option for the WebTool Mode

CLIENT_TIME_OUT=300
Sets the session timeout in seconds for the Network Diagnostic Tool.

8.3.2. Options for the PEER Routing Mode

BROADCAST=1
This option allows the Digi to broadcast messages to the local subnet when it doesn't know the IP mapping for a PEER address.

LEARN=1
This option allows the Digi to learn the IP mapping of a PEER address sent to it. When used with BROADCAST, it will only let the first few messages be broadcast on the network, after which messages will be directed.

TTL=300
This option is used with LEARN to set a time for how long the learned IP mapping is in use. When the time since the last message exceeds this time, the learned IP mapping is removed.

PORT=60000
This option specifies what internet port address to listen for PEER messages on.

PAIR=0
This option specifies that routing is based on the full source/destination pair. This is used when multiple locations has the same source address, so the only way to uniquely identify where each message should go is to use both the source and destination addresses as a pair.

8.3.3. UDP Options

Entries in this section are specified as:

<local_port>:<remote_ip_addr>:<remote_port>=<mlk_addr_list>

remote_ip_addr is the Internet address of the remote unit where the MLK addresses listed in the mlk_addr_list reside.

remote_port is the Internet port of the remote unit where the MLK address listed in the mlk_addr_list reside.

mlk_addr_list is specified as:
<mlk_addr>[,<mlk_addr_list>]

mlk_addr is specified as:
<mlk_dest_addr>[:<mlk_source_addr]

The Microlok Addresses has to be in 4-digit Hexadecimal notation. For example, Address 10 maps to 000A, and Address 20 maps to 0014

Example:
192.168.1.16:60000=000A
192.178.1.17:60000=0014

In the application.ml2 file:
PROTOCOL: MII.PEER
ADJUSTABLE PORT: 1;
ADJUSTABLE MII.ADDRESS: 10
STATION.NAME: STATION_1;
ADJUSTABLE PEER.ADDRESS: 20;

This definition defines a MII.PEER port and a station. The station address is 10, and the address it is communicating with is address 20. So messages sent from the station has a source address of 10, and a destination address of 20.

PROTOCOL: MII.PEER
ADJUSTABLE PORT: 2;
ADJUSTABLE MII.ADDRESS: 20
STATION.NAME: STATION_2;
ADJUSTABLE PEER.ADDRESS: 10;

This definition is the other end of the communication. Messages sent from this link have a source address of 20 and a destination address of 10.

In the example, the Digi with address 192.168.1.16 should be connected to PORT 1, and the Digi with address 192.168.1.17 should be connected to PORT 2.

With PAIR routing, the following definition would work:

Digi device configured with IP=192.168.1.17 in the header of the niacfg.ini file contains a UDP table entry:
192.168.1.16:60000=000A:0014

Digi device configured with IP=192.168.1.16 in the header of the niacfg.ini file contains a UDP table entry:
192.178.1.17:60000=0014:000A

8.3.4. [TCP] Options

Entries in this section are specified as:

<local_port>:<remote_ip_addr>:<remote_port>=<mlk_addr_list>

TCP table entries are identical to UDP table entries except that TCP specifies an IP port that is used for inbound connections. Commonly referred to as a Listening port. This ensures that data connections can be initiated by either the Object Controller being configured or the remote Object Controller. If creating a third party device to communicate with the Object Controller it should be noted that outbound TCP connections from the Object Controller are not guaranteed and are dependent on addressing schemes.

example:
4001:192.168.1.12:6001=000C
6001:192.168.1.11:4001=000D

local_port is the Listening port and remote_port is the port used for outbound connections.

8.3.5. HMAC Options

HMAC, or a hash-keyed message authentication code, provides a way to check the integrity of data sent through the communication links. HMAC provides integrity checking based on "message authentication codes" (MAC). MACs are used between two parties that share a secret key so that the information transmitted between these two parties can be validated.

HMAC adds a message authentication protocol on top of the PEER protocol. A Key Server is required for this function to work. When HMAC is enabled, all messages are sent encapsulated with the HMAC protocol.

Entries in this section are specified as:

HMAC=0	(0=HMAC disabled, 1=HMAC enabled)
SERVER=0.0.0.0	(HMAC Key Server IP address)
PORT=5840	(HMAC Key Server IP port)
KEY.TIMEOUT=2000	(Time in seconds between HMAC Key heartbeat messages)
KEY.RETRYS=3	(Number of missed heartbeats before key is declared invalid)

8.4. Erasing the Existing Configuration File

If the file system on the Object Controller is not working, you may wish to completely erase the configuration file (niacfg.ini) from the embedded file system using the following procedure.

1. Make sure you have a known-good or factory-default-settings configuration file on hand to upload after deleting the existing configuration file or rebooting the Object Controller. See Section 5.5 for information on downloading an existing configuration file or Section 8.1 for the factory-default Web tool configuration file or Section 8.2 for a factory application port configuration file. The factory niacfg.ini file is on the CD that is shipped with the unit.

2. Access the Object Controller Configuration Home Page. See Section 5.4 for the procedure.
3. Click on the **Network Adapter Advanced Options** link (Figure 5-3).
4. On the Advanced Tools page, click on the **Erase** link (Figure 8-1).

   The system displays a password box (Figure 8-1).

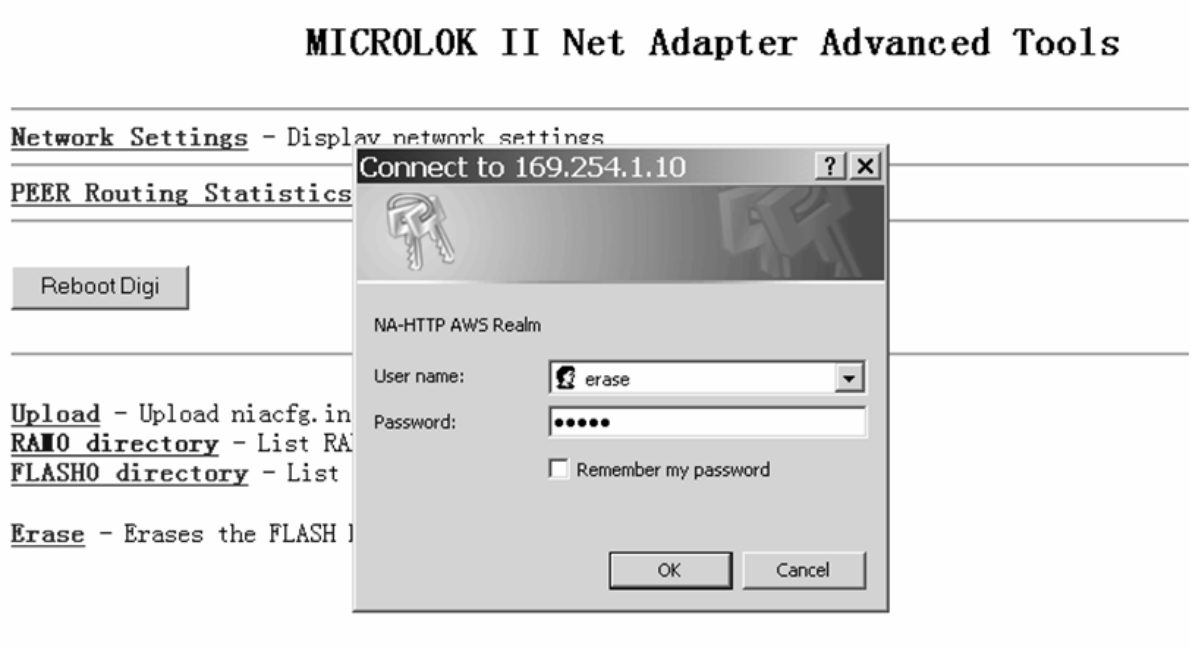


Figure 8-1. Erases Flash Function Password Dialog Box

5. Type in **erase** for both the user name and password and click OK.

   The system will display the confirmation screen shown in Figure 8-2.

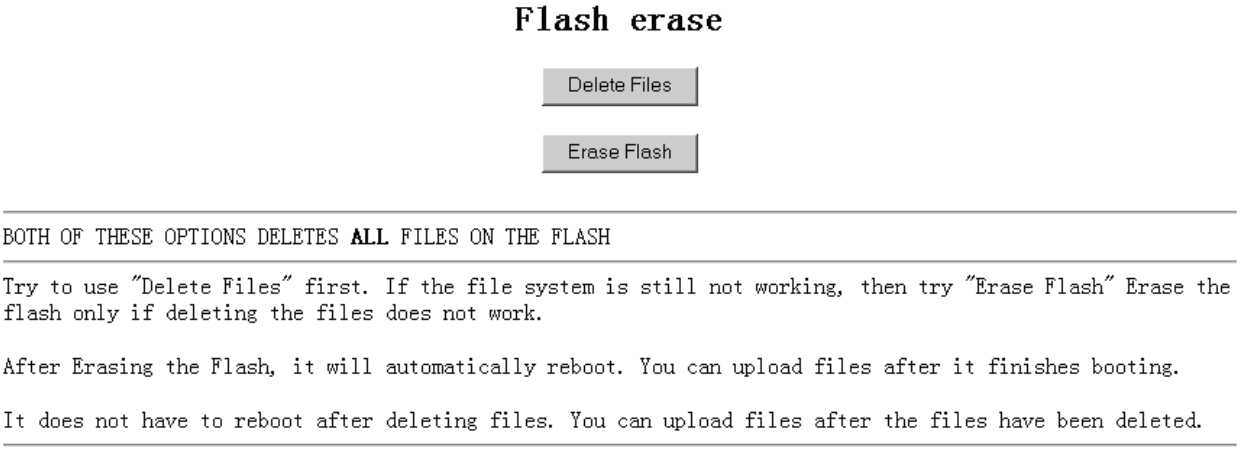

Flash erase
Delete Files
Erase Flash
BOTH OF THESE OPTIONS DELETES ALL FILES ON THE FLASH
Try to use "Delete Files" first. If the file system is still not working, then try "Erase Flash" Erase the flash only if deleting the files does not work.
After Erasing the Flash, it will automatically reboot. You can upload files after it finishes booting.
It does not have to reboot after deleting files. You can upload files after the files have been deleted.

Figure 8-2. Erase Flash Function Confirmation Page

6. First, try to correct the problem by deleting the configuration file. If that works, upload a new configuration file (See Section 5.6.3).

If deleting the configuration file does not correct the problem click the **Erase Flash** button.

The system will delete the configuration file (if it is not already deleted) and then reboot the Object Controller, thereby erasing the settings in Flash memory. After the Object Controller reboots, you can upload any configuration file, which may be the Factory default.

9. GPS.MASTER SPECIFICATIONS

OC Executive Version 1.3 and higher allow for the following GPS time-setting features.

NOTE

GPS Protocol will be used interchangeably with Trimble Protocol.

The GPS.MASTER protocol communication driver implements a subset of the Trimble Standard Interface Protocol (TSIP) described in Trimble publications 58873-00 and 34462-00. The purpose of this communication link is to obtain an accurate time from the GPS satellite constellation using a GPS time receiver to set the Object Controller real time clock and provide time for the CLASSC.EMP protocol communication driver described later in this manual. Currently only the Trimble Acutime Gold Smart Antenna (Trimble P/N 55238-00) is supported. Other Trimble GPS time receivers will be certified for use with this communication driver as required.

9.1.1.1. Physical Connections

The GPS.MASTER link must be assigned to "Port 2" in the Object Controller application program. The GPS receiver must be connected to the 9-pin D serial connector (COM2) on the Object Controller using a ASTS USA serial isolator / converter (N16404701) and Acutime Gold Smart Antenna cable (Trimble P/N 60148) as shown in Figure 9-1. The function of the serial isolator / converter is to change the RS-422 signal levels produced by the GPS receiver to the RS-232 levels expected by Object Controller COM2. The isolation provided by the ASTS USA isolator / converter is not required unless the GPS receiver is powered by a power source that is isolated from the Object Controller power source.

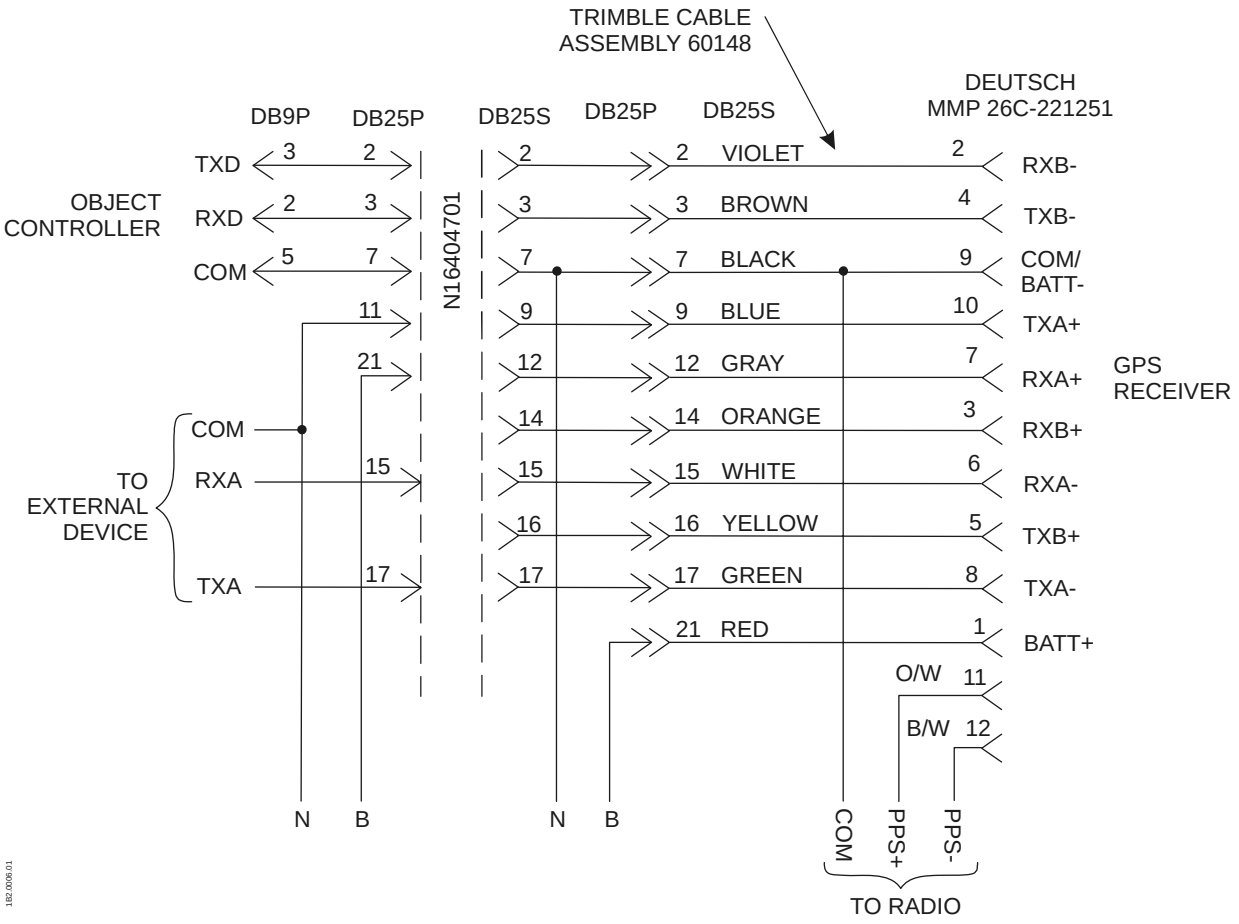


Figure 9-1. Acutime Gold Connector

9.1.1.2. GPS.MASTER Protocol Link Destination

The GPS.MASTER protocol communication driver is defined in the Object Controller application program in a manner similar to that used to define other Object Controller communication protocol drivers. The GPS.MASTER configuration parameters are listed and described in Table 9-1. The GPS.MASTER protocol communication driver communicates with a single GPS receiver and unlike other Object Controller serial communication drivers does not support the definition of "stations." See application program example in Section 13.3.

Table 9-1. GPS Protocol Link Compiler Declarations and Configuration Commands

COMMAND	FUNCTION
LINK	Declares an GPS protocol serial link and defines the link name. The link name is a user-selectable text string. No default. Not adjustable.
ENABLE	Specifies whether or not the GPS protocol link will be enabled on unit initialization. 0 = DISABLED; 1 = ENABLED. No default.
PROTOCOL	"GPS.MASTER" declares that this link will support the GPS protocol. No default. Not adjustable.
PORT	The physical port to which the GPS link will be attached. The GPS may be assigned to Port 1 or 2. There is no default.
BAUD	The data rate at which the link will operate. Available selections are 4800, 7200, 9600, 19200, and 38400 bits per second. The default rate is 9600.
STALE.DATA.TIMEOUT	Specifies the elapsed time after which the serial communication link between master and slave is declared failed when no valid messages between the master and slave have been processed. Allowable values are 5,000 to 600,000 milliseconds. The default value is 300,000 milliseconds.
LINK.TIMEOUT	Allowable values are 5,000 to 60,000 milliseconds. The default value is 60,000 milliseconds.
MASTER.TIMEOUT	Specifies the time a master protocol handler will wait for a response after addressing a slave. This delay must be long enough to accommodate the worst expected communication delays imposed by the communication circuit. Consult documentation provided by the communication equipment supplier for specific information. The default value is usually adequate, but when using a communication circuit with smaller end-to-end delays, a lower timeout can improve link performance when some slaves are not answering regularly due to intermittent communication problems. Allowable values are 30 to 10,000 milliseconds. The default value is 1100 milliseconds.
INTERBYTE.TIMEOUT	Allowable values are 0 to 100 milliseconds. The default value is 0 milliseconds. A setting of 0 selects 3 character times at the selected data rate.
DYNAMICS.CODE	Allowable values are 1 to 4. The default value is 4.
MINIMUM.SIGNAL	The minimum signal required for the GPS receiver. Allowable values are 2.0 to 10.0. The default value is 2.0.
MAXIMUM.PDOP	The maximum position dilution of precision necessary to receive a proper signal. Allowable values are 4.0 to 30.0. The default value is 8.0.

9.1.1.3. GPS.Master Protocol Link Configuration

In the main menu, click on the link labeled "System Configuration" Longin. Select the appropriate link button to modify or view the configuration elements. Figure 9-2 presents the configuration of the GPS Protocol Link.

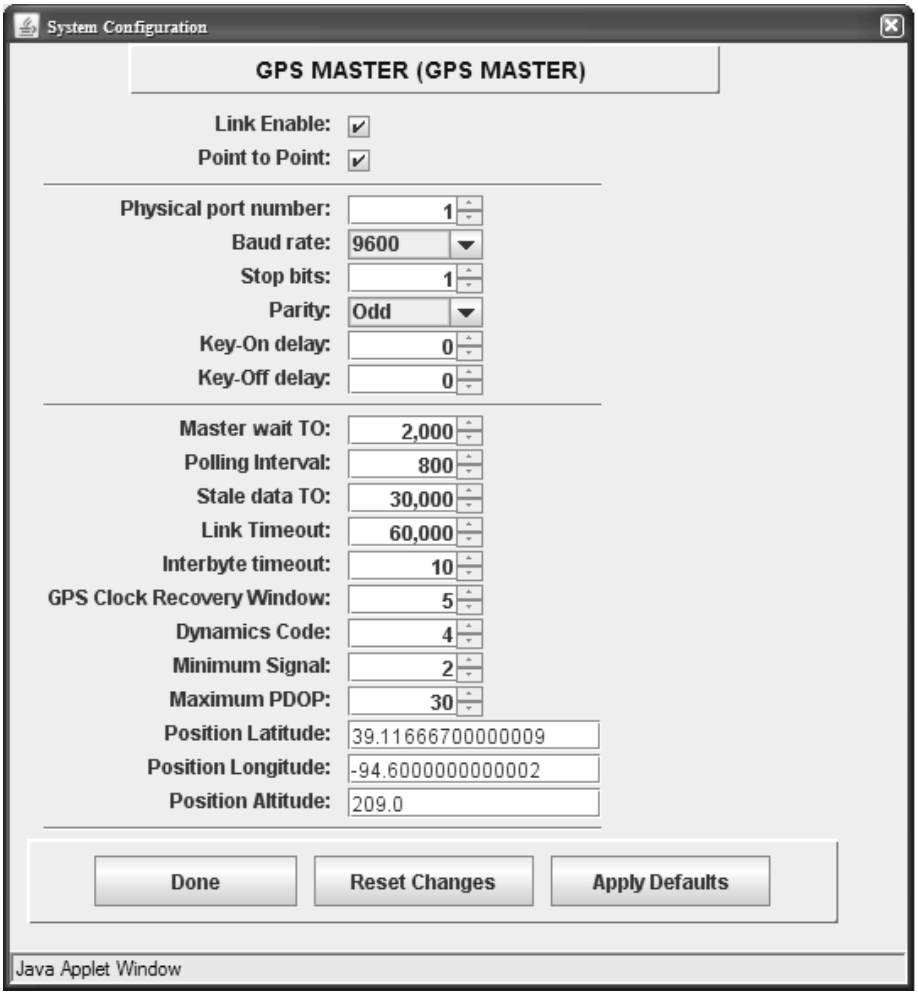


Figure 9-2. GPS Protocol Link

9.1.1.4. GPS.Master Protocol Link Statistics

In the main menu, click on the link labeled "Link Information." This will bring up a menu that will allow the user to view statistical information for communication. To enter the Link Information view for a particular link, simply click on the appropriate button (See Figure 9-3). Figure 9-6 presents the GPS Protocol Link Statistics Display.

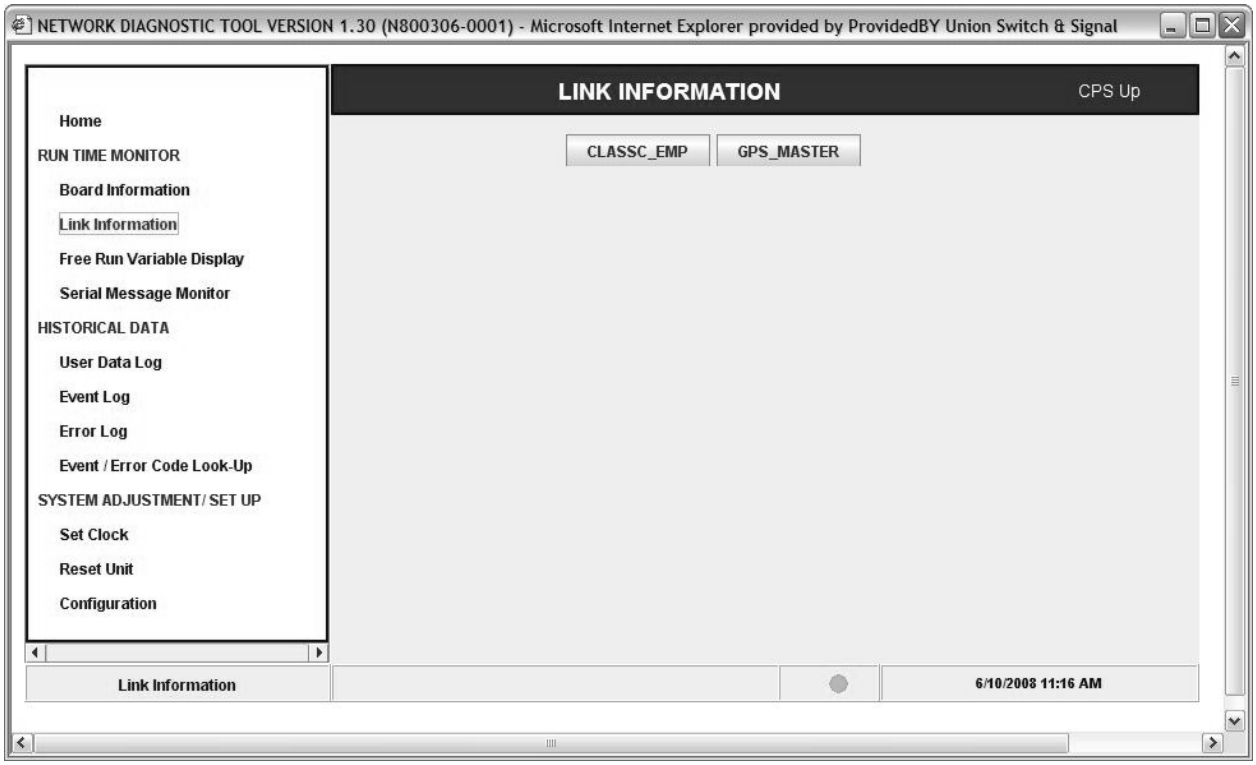


Figure 9-3. Link Information Window

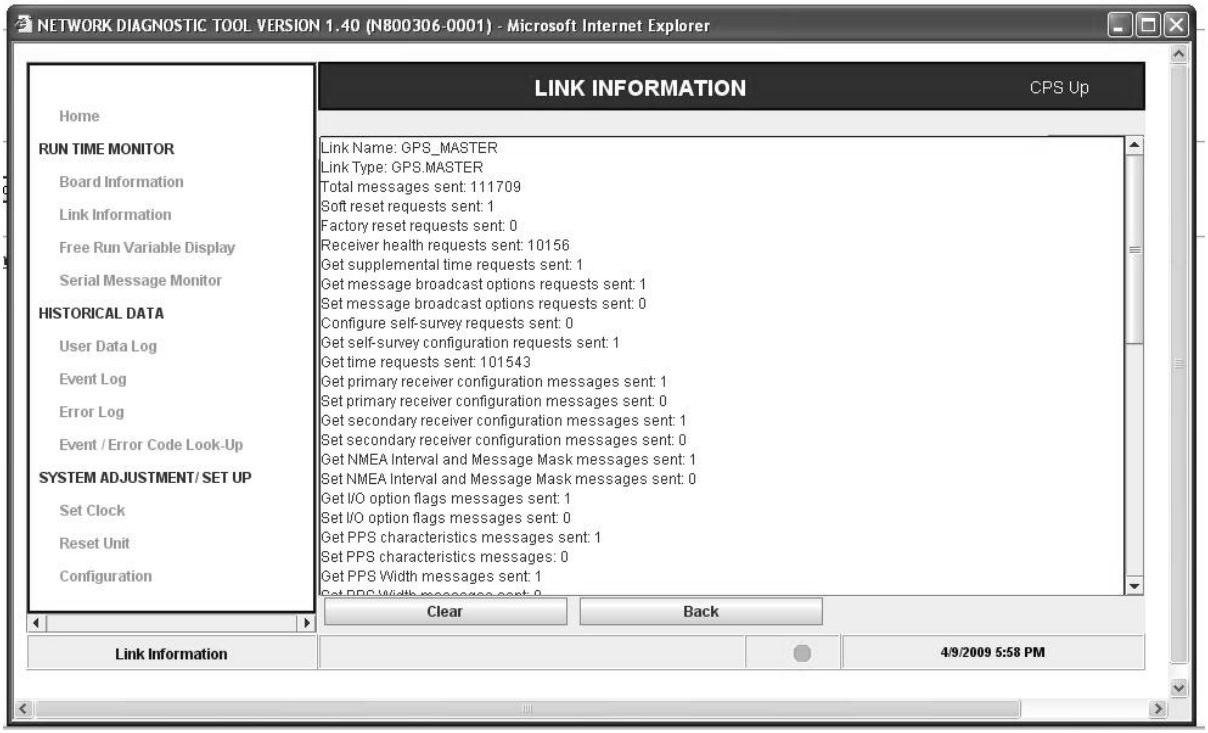

NETWORK DIAGNOSTIC TOOL VERSION 1.40 (N800306-0001) - Microsoft Internet Explorer
Home
RUN TIME MONITOR
Board Information
Link Information
Free Run Variable Display
Serial Message Monitor
HISTORICAL DATA
User Data Log
Event Log
Error Log
Event / Error Code Look-Up
SYSTEM ADJUSTMENT/ SET UP
Set Clock
Reset Unit
Configuration
LINK INFORMATION
CPS Up
Link Name: GPS_MASTER
Link Type: GPS.MASTER
Total messages sent: 111709
Soft reset requests sent: 1
Factory reset requests sent: 0
Receiver health requests sent: 10156
Get supplemental time requests sent: 1
Get message broadcast options requests sent: 1
Set message broadcast options requests sent: 0
Configure self-survey requests sent: 0
Get self-survey configuration requests sent: 1
Get time requests sent: 101543
Get primary receiver configuration messages sent: 1
Set primary receiver configuration messages sent: 0
Get secondary receiver configuration messages sent: 1
Set secondary receiver configuration messages sent: 0
Get NMEA Interval and Message Mask messages sent: 1
Set NMEA Interval and Message Mask messages sent: 0
Get I/O option flags messages sent: 1
Set I/O option flags messages sent: 0
Get PPS characteristics messages sent: 1
Set PPS characteristics messages: 0
Get PPS Width messages sent: 1
Clear
Back
Link Information
4/9/2009 5:58 PM

Figure 9-4. Network Diagnostic Tool – Link Information (1 of 3)

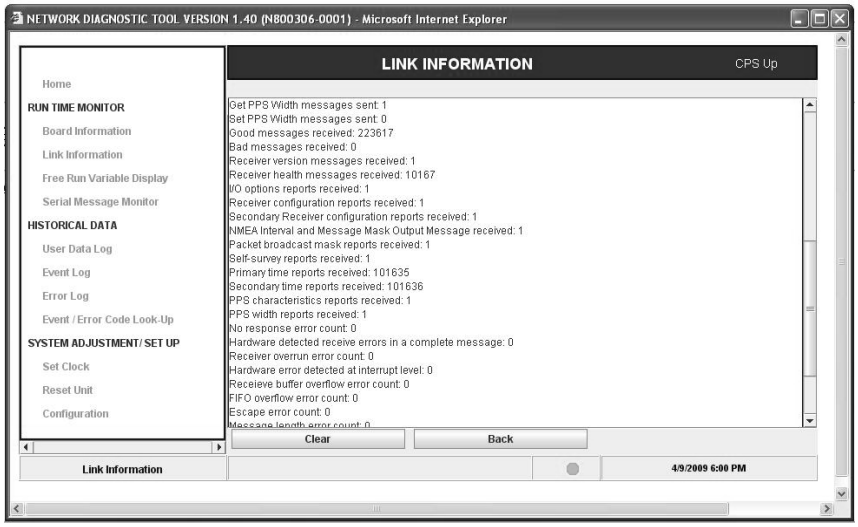

NETWORK DIAGNOSTIC TOOL VERSION 1.40 (N800306-0001) - Microsoft Internet Explorer
Home
RUN TIME MONITOR
Board Information
Link Information
Free Run Variable Display
Serial Message Monitor
HISTORICAL DATA
User Data Log
Event Log
Error Log
Event / Error Code Look-Up
SYSTEM ADJUSTMENT/ SET UP
Set Clock
Reset Unit
Configuration
LINK INFORMATION
CPS Up
Get PPS Width messages sent: 1
Set PPS Width messages sent: 0
Good messages received: 223617
Bad messages received: 0
Receiver version messages received: 1
Receiver health messages received: 10167
I/O options reports received: 1
Receiver configuration reports received: 1
Secondary Receiver configuration reports received: 1
NMEA Interval and Message Mask Output Message received: 1
Packet broadcast mask reports received: 1
Self-survey reports received: 1
Primary time reports received: 101635
Secondary time reports received: 101636
PPS characteristics reports received: 1
PPS width reports received: 1
No response error count: 0
Hardware detected receive errors in a complete message: 0
Receiver overrun error count: 0
Hardware error detected at interrupt level: 0
Receieve buffer overflow error count: 0
FIFO overflow error count: 0
Escape error count: 0
Clear
Back
Link Information
4/9/2009 6:00 PM

Figure 9-5. Network Diagnostic Tool – Link Information (2 of 3)

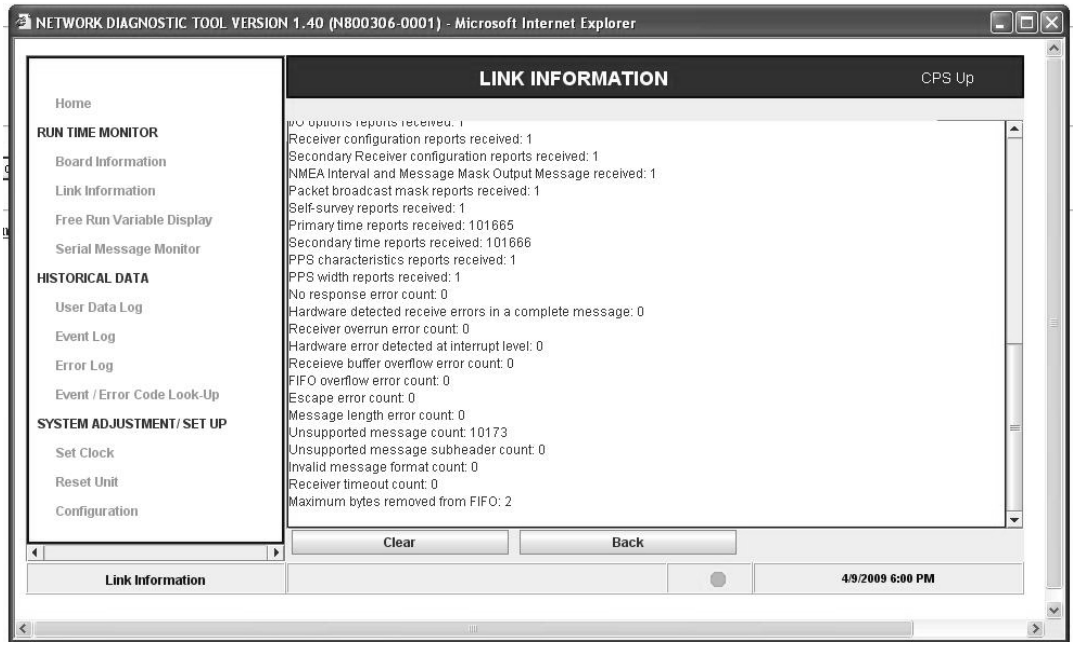

NETWORK DIAGNOSTIC TOOL VERSION 1.40 (N800306-0001) - Microsoft Internet Explorer
Home
RUN TIME MONITOR
Board Information
Link Information
Free Run Variable Display
Serial Message Monitor
HISTORICAL DATA
User Data Log
Event Log
Error Log
Event / Error Code Look-Up
SYSTEM ADJUSTMENT/ SET UP
Set Clock
Reset Unit
Configuration
LINK INFORMATION
CPS Up
Receiver configuration reports received: 1
Secondary Receiver configuration reports received: 1
NMEA Interval and Message Mask Output Message received: 1
Packet broadcast mask reports received: 1
Self-survey reports received: 1
Primary time reports received: 101665
Secondary time reports received: 101666
PPS characteristics reports received: 1
PPS width reports received: 1
No response error count: 0
Hardware detected receive errors in a complete message: 0
Receiver overrun error count: 0
Hardware error detected at interrupt level: 0
Receieve buffer overflow error count: 0
FIFO overflow error count: 0
Escape error count: 0
Message length error count: 0
Unsupported message count: 10173
Unsupported message subheader count: 0
Invalid message format count: 0
Receiver timeout count: 0
Maximum bytes removed from FIFO: 2
Clear
Back
Link Information
4/9/2009 6:00 PM

Figure 9-6. Network Diagnostic Tool – Link Information (3 of 3)

9.1.1.5. GPS.Master Protocol Link Serial Message Monitor

In the menu, click on the link labeled "Serial Message Monitor." Select the appropriate link to monitor from the list on the left to monitor. Figure 9-7 presents a typical display for the GPS Protocol Monitor. The protocol monitor display for the GPS Protocol Link shows message time, message direction (transmitted or received), and message type followed by the full text of the transmitted or received message in hexadecimal bytes.

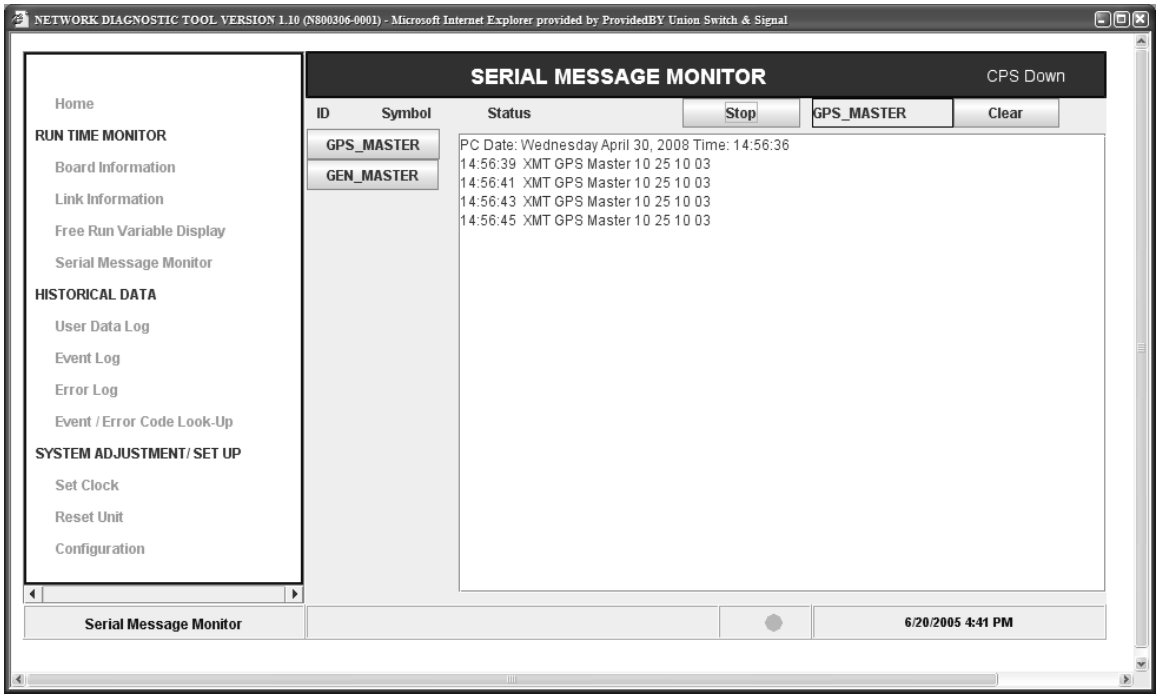


Figure 9-7. Network Diagnostic Tool – Serial Message Monitor

9.1.2. CLASSC.EMP Protocol Link Specifications

The CLASSC.EMP protocol communication driver supports communication with a Microwave Data Systems entraNET 220 data radio to deliver signal aspect information via a wireless radio frequency link to equipped locomotives.

9.1.2.1. Physical Connections

Connection to the radio is made via an RJ-45 Ethernet connecter.

See MDS entraNET 220 data radio application documentation for connection information.

9.1.2.2. CLASSC.EMP Protocol Link Definition

The CLASSC.EMP protocol communication driver is defined in the Object Controller application program in a manner similar to that used to define other Object Controller communication protocol drivers. The CLASSC.EMP link configuration parameters are listed and described in Table 9-2. See application program example in Section 13.3.

Table 9-2. CLASSC.EMP Protocol Link Compiler Commands and Their Functions

COMMAND	FUNCTION
LINK	Declares an CLASSC protocol serial link and defines the link name. The link name is a user-selectable text string. No default. Not adjustable.
ENABLE	Specifies whether or not the CLASS protocol link will be enabled on unit initialization. 0 = DISABLED; 1 = ENABLED. No default.
PROTOCOL	"CLASSC.EMP" declares that this link will support the CLASSC. No default. Not adjustable.
PORT	The physical port to which the CLASSC.EMP link will be attached. The CLASSC.EMP can be assigned to Port 1 or 2. There is no default.
BAUD	The data rate at which the link will operate. Available selections are 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, and 19200 bits per second. The default rate is 9600.
NO.RESPONSE.TIMEOUT	Allowable values are 30 to 10,000 milliseconds. The default value is 1,000 milliseconds.
EMP.SOURCE.ADDRESS	Message profile logical expression parameter. 80 character maximum. The default value is "WIUxxxxxxxx.wayside.up.com"
LINK.FAIL.TIMEOUT	Allowable values are 1,000 to 60,000 milliseconds. The default value is 60,000 milliseconds.
MESSAGE.TYPE	Allowable values are 1 to 65,535. The default value is 1.
MESSAGE.VERSION	Allowable values are 1 to 255. The default value is 1.
INTERBYTE.TIMEOUT	Allowable values are 0 to 100 milliseconds. The default value is 0 milliseconds. A setting of 0 selects 3 character times at the selected data rate.
WIU.ADDRESS.SIZE	Maximum number of bits that the wayside radio can accept for a WIU channel address. Allowable values are 16 to 32. The default value is 24.
MESSAGE.TYPE.SIZE	Maximum number of bits that the wayside radio can accept for a message type. Allowable values are 4 to 16. The default value is 6.
MESSAGE.VERSION.SIZE	Maximum number of bits that the wayside radio can accept for a message version. Allowable values are 4 to 8. The default value is 4.

COMMAND	FUNCTION
MESSAGE.DATA.SIZE	Vital payload size. Total number of bits allocated to the vital data. Allowable values are 64 to 184. The default value is 64.
MESSAGE.DIGEST.SIZE	Size of the target fields in the WIU message. Allowable values are 32 to 160. The default value is 32.
ENCRYPTED.KEY	HMAC key used in the message security algorithm. Allowable values are 8 to 64 hexadecimal bytes. There is no default.
EMP.TYPE	Allowable values are 0 to 65,535. The default value is 20,480.
BROADCAST.CHANGE	Broadcast a device status change immediately after it occurs. Allowable values are 0 or 1. The default value is 0.

9.1.2.3. CLASSC.EMP Protocol Station Definition

The CLASSC.EMP protocol communication driver supports the definition of 1 to 3 stations each supporting the transmission of 1 to 128 bits of signal aspect information. (Note, however, that at the time of printing of this manual, the available radio equipment only supports transmission of 30 bits of signal aspect information.) Boolean bits may be assigned to these stations as required by the application programmer. The CLASSC.EMP link does not receive any messages. The CLASSC.EMP station configuration parameters are listed and described in Table 9-3.

Table 9-3. CLASSC.EMP Protocol Station Configuration Parameters

COMMAND	FUNCTION
ADDRESS	Declares a station on a CLASSC.EMP link and assigns its address. There is no default.
ENABLE	Specifies whether or not an CLASSC.EMP will be enabled on unit initialization. 0 = DISABLED; 1 = ENABLED. There is no default.
STATION.NAME	A user-defined string that defines the name of a CLASSC.EMP station. There is no default.
RADIO.CONFIG.STRING	String(s) of hexadecimal bytes enclosed in double quotes containing radio ID, time slot, and frequency information. As many as four string segments may be specified. Each string segment may be up to 32 bytes long. The default value is the NULL string ("").
BROADCAST.INTERVAL	Broadcast interval of a WIU message with current device status. Allowable values are 250 to 60,000 milliseconds. The default value is 1,000 milliseconds.
TEST.INTERVAL	Interval in which test status message are transmitted. Allowable values are 10,000 to 3,600,000 milliseconds. The default value is 60,000 milliseconds.
OUTPUT	Defines a list of Boolean values (logic bits) to be sent serially. The list may include 1 to 128 Boolean bits

9.1.2.4. CLASS.EMP Protocol Link System Boolean Bits

The Object Controller application compiler automatically generates six Boolean bits that provide information on CLASSC.EMP link status to the application program or allow the application program to change the status of the CLASSC.EMP link. These bits are listed and described in Table 9-4.

Table 9-4. CLASSC.EMP Protocol Link System Boolean Bits

EXPRESSION	FUNCTION
<link_name>.ENABLED	A read-only Boolean bit that indicates to the application whether or not the CLASSC.EMP link is enabled in the link configuration. 0 = DISABLED; 1 = ENABLED.
<link_name>.DISABLE	A Read/Write Boolean bit that allows the application program to disable a CLASSC.EMP Link.
<link_name>.STANDBY	This Boolean bit has no function.
<link_name>.<slave_name>.ENABLED	A read-only Boolean bit that indicates whether or not a slave is enabled. "nn" is the slave address. 0 = DISABLED; 1 = ENABLED.
<link_name>.<slave_name>.DISABLE	A read/write Boolean bit that allows the application program to disable a specific CLASSC.EMP station.
<link_name>.slave_name>.STATUS	A read-only Boolean bit that indicates the current status of slave communication. "nn" is the slave address. 0 = FAILED; 1 = NORMAL.
<link_name>.<slave_name>. INPUTS.RECEIVED	This Boolean bit has no function .

9.1.2.5. Network Diagnostic Tool Support for the CLASSC.EMP Protocol Link

This section describes the part of the Network Diagnostic Tool that is applicable to the CLASSC.EMP Protocol.

9.1.2.5.1. CLASSC.EMP Protocol Link Configuration

In the main menu, click on the link labeled "System Configuration." Select the appropriate link button to modify or view the configuration elements. Figure 9-8 presents the configuration of the CLASSC.EMP Protocol Link. CLASSC.EMP Protocol link configuration parameters are described in Section 9.1.2.3 of this manual.

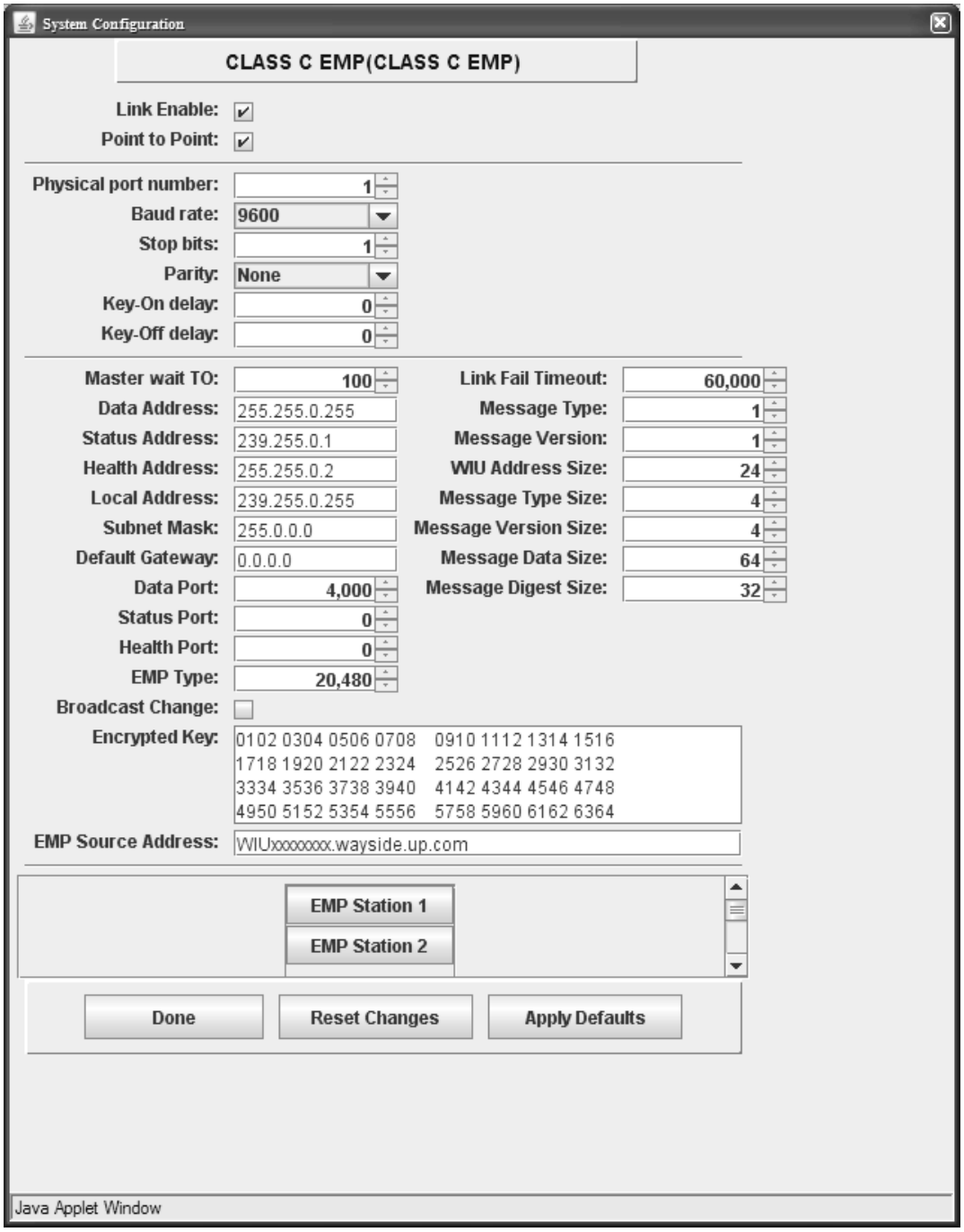


Figure 9-8. CLASSC.EMP Protocol Link Configuration

9.1.2.5.2. CLASSC.EMP Protocol Station Configuration

In the main menu, click on the link labeled "System Configuration." Select the appropriate link button to modify or view the configuration elements. Select the CLASSC.EMP protocol station to configure. Figure 9-9 presents the CLASSC.EMP Protocol Station configuration. CLASSC.EMP Protocol station configuration parameters are described in Section 9.1.2.4 of this manual.

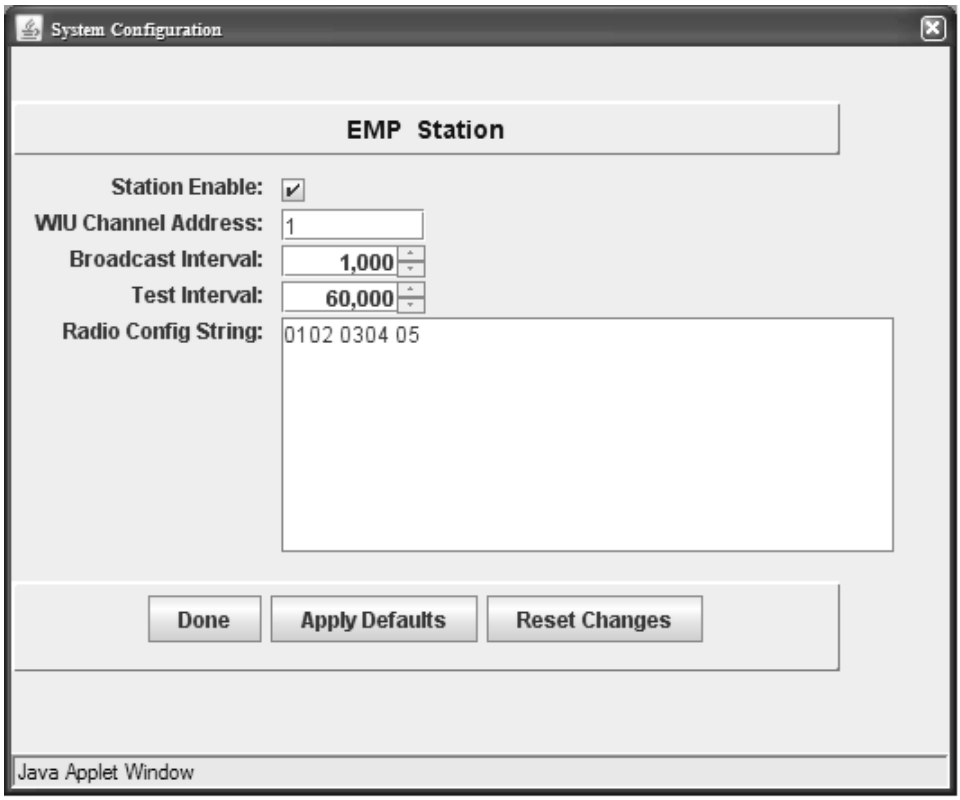


Figure 9-9. CLASSC.EMP Station Configuration

9.1.2.5.3. CLASSC.EMP Protocol Link Statistics

In the main menu, click on the button labeled "Link Information." This will bring up a menu that will allow the user to view statistical information for both boards and protocol links. To enter the Link Information view for a particular link, simply click on the appropriate button. Figure 9-10 presents the CLASSC.EMP Protocol Link Statistics Display.

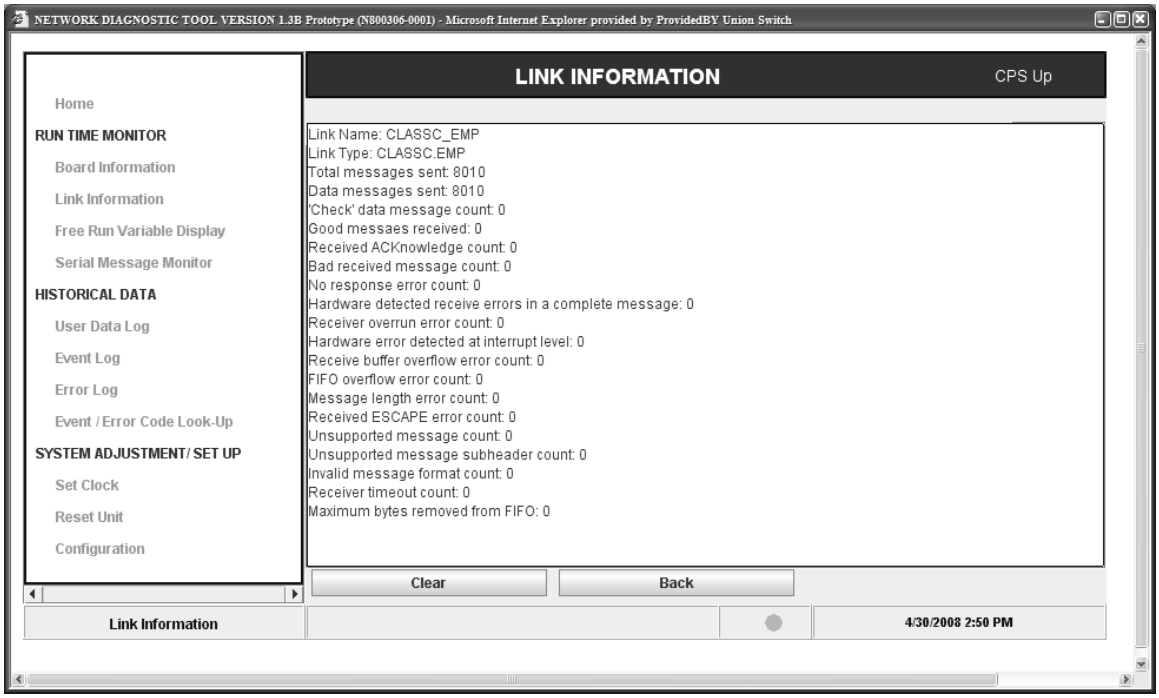


Figure 9-10. Link Information – CLASSC.EMP

9.1.2.5.4. CLASSC.EMP Protocol Serial Message Monitor

In the main menu, click on the link labeled "Serial Message Monitor." Select the appropriate link to monitor from the list on the left to monitor. Figure 9-11 presents a typical display for the CLASSC.EMP Protocol Monitor. The protocol monitor display for the CLASSC.EMP Protocol Link shows message time, message direction (transmitted or received), and message type followed by the full text of the transmitted or received message in hexadecimal bytes. Please refer to an appropriate CLASSC.EMP Protocol document for additional information on the CLASSC.EMP Protocol.

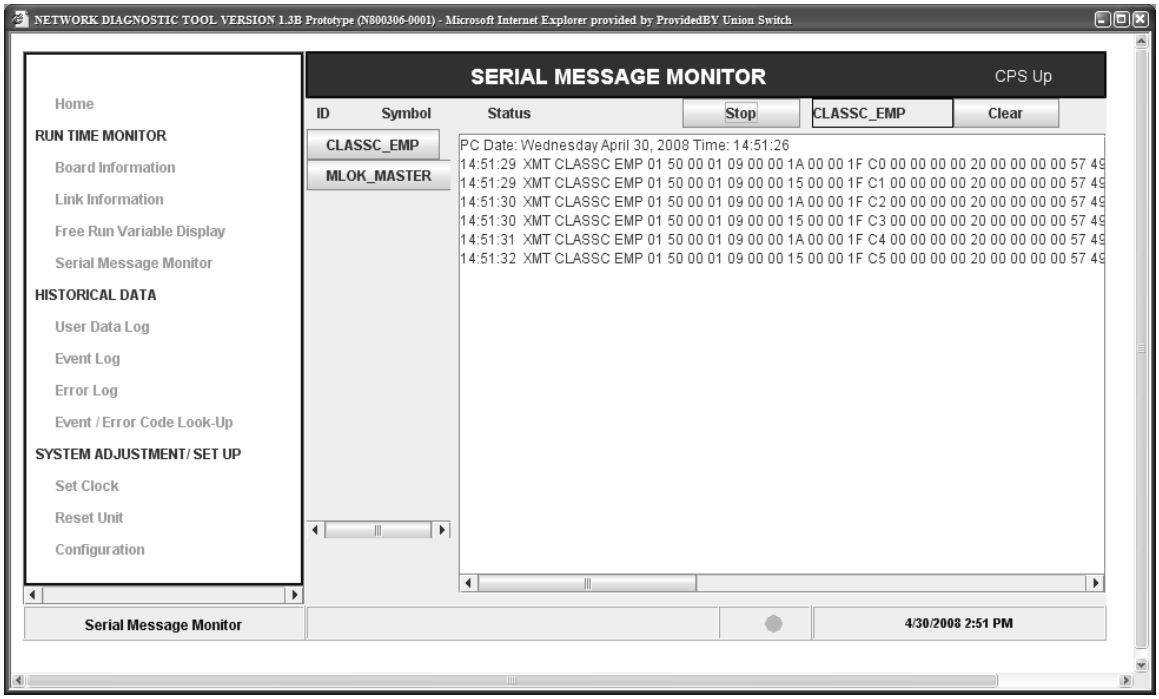

NETWORK DIAGNOSTIC TOOL VERSION 1.3B Prototype (N800306-0001) - Microsoft Internet Explorer provided by ProvidedBY Union Switch
SERIAL MESSAGE MONITOR
CPS Up
Home
RUN TIME MONITOR
Board Information
Link Information
Free Run Variable Display
Serial Message Monitor
HISTORICAL DATA
User Data Log
Event Log
Error Log
Event / Error Code Look-Up
SYSTEM ADJUSTMENT/ SET UP
Set Clock
Reset Unit
Configuration
ID
Symbol
Status
Stop
CLASSC_EMP
Clear
CLASSC_EMP
MLOK_MASTER
PC Date: Wednesday April 30, 2008 Time: 14:51:26
14:51:29 XMT CLASSC EMP 01 50 00 01 09 00 00 1A 00 00 1F C0 00 00 00 00 20 00 00 00 00 57 49
14:51:29 XMT CLASSC EMP 01 50 00 01 09 00 00 15 00 00 1F C1 00 00 00 00 20 00 00 00 00 57 49
14:51:30 XMT CLASSC EMP 01 50 00 01 09 00 00 1A 00 00 1F C2 00 00 00 00 20 00 00 00 00 57 49
14:51:30 XMT CLASSC EMP 01 50 00 01 09 00 00 15 00 00 1F C3 00 00 00 00 20 00 00 00 00 57 49
14:51:31 XMT CLASSC EMP 01 50 00 01 09 00 00 1A 00 00 1F C4 00 00 00 00 20 00 00 00 00 57 49
14:51:32 XMT CLASSC EMP 01 50 00 01 09 00 00 15 00 00 1F C5 00 00 00 00 20 00 00 00 00 57 49
Serial Message Monitor
4/30/2008 2:51 PM

Figure 9-11. Network Diagnostic Tool – Serial Message Monitor

10. NETWORK DIAGNOSTIC TOOL (WEBTOOL)

This section details the use of the ASTS USA OC and its web tools interface (the Network Diagnostic Tool). It provides information on maintenance and troubleshooting techniques necessary for personnel to maintain the OC in a manner that ensures operational integrity with a minimum of downtime.

10.1. Minimum Requirements

- PC with Ethernet port. Ethernet crossover cable for direct connection to the Object Controller or a standard Ethernet cable for connection to a network or a hub.
- The Network Diagnostic Tool requires, as a minimum:
- Internet Explorer Version 6.0 or higher.
- Java Run Time Environment Version 1.4.2 or higher.
- Ethernet crossover cable for direct connection to the Object Controller or a standard Ethernet cable for connection to a network or a hub.

10.2. Launching the Network Diagnostic Tool

NOTE

Java must be installed and enabled on the PC. Please refer to the Java Run Time Environment found on the CD supplied with the Object Controller.

This tool is accessible by using Internet Explorer and connecting to the Ethernet Port labeled WebTool on the OC. For example, if the WebTool Ethernet Port is at IP address 192.168.1.12, you would type into the Internet Explorer browser address bar: http://192.l68.1.12/.

It will prompt for a username/password. Enter **webtools** for the username, and **uss1** for the password (u-s-s, then the number 1). Click on Launch Network Diagnostic Tool to start the Java application, which establishes the connection between the PC and OC.

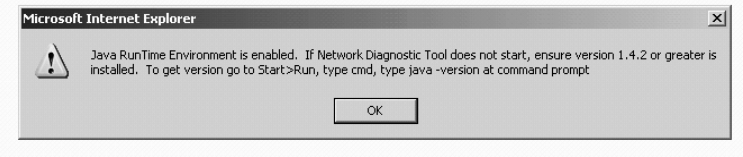

Microsoft Internet Explorer
Java RunTime Environment is enabled. If Network Diagnostic Tool does not start, ensure version 1.4.2 or greater is installed. To get version go to Start>Run, type cmd, type java -version at command prompt
OK

Figure 10-1. Java Version Verification Dialog Box

The box shown in Figure 10-1 prompts the user to the appropriate version of the Java. Click "OK' to continue to open Java.

If the java version is correct the Java application launches (See Figure 10-2).

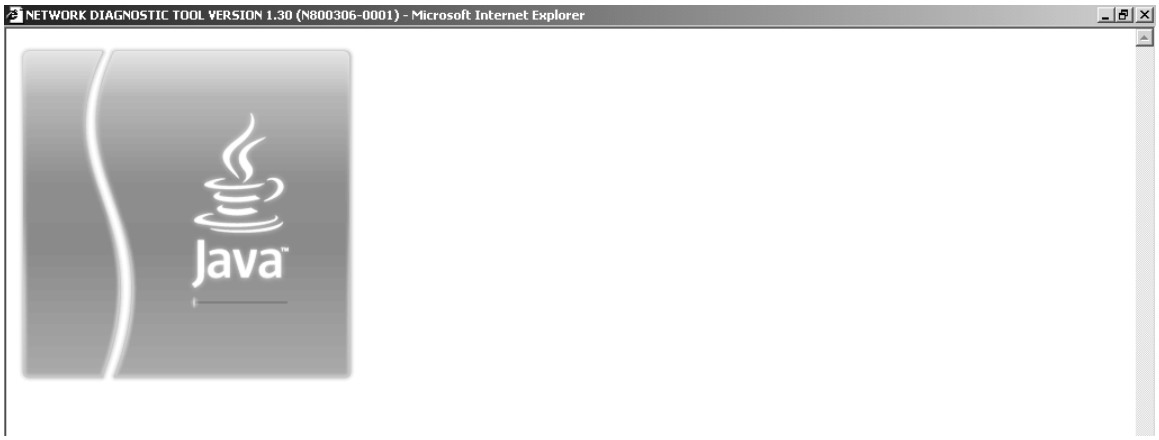


Figure 10-2. Java Open Splash Screen

The Network Diagnostic toll opens and begins to establish communications with the OC. (See Figure 10-3).

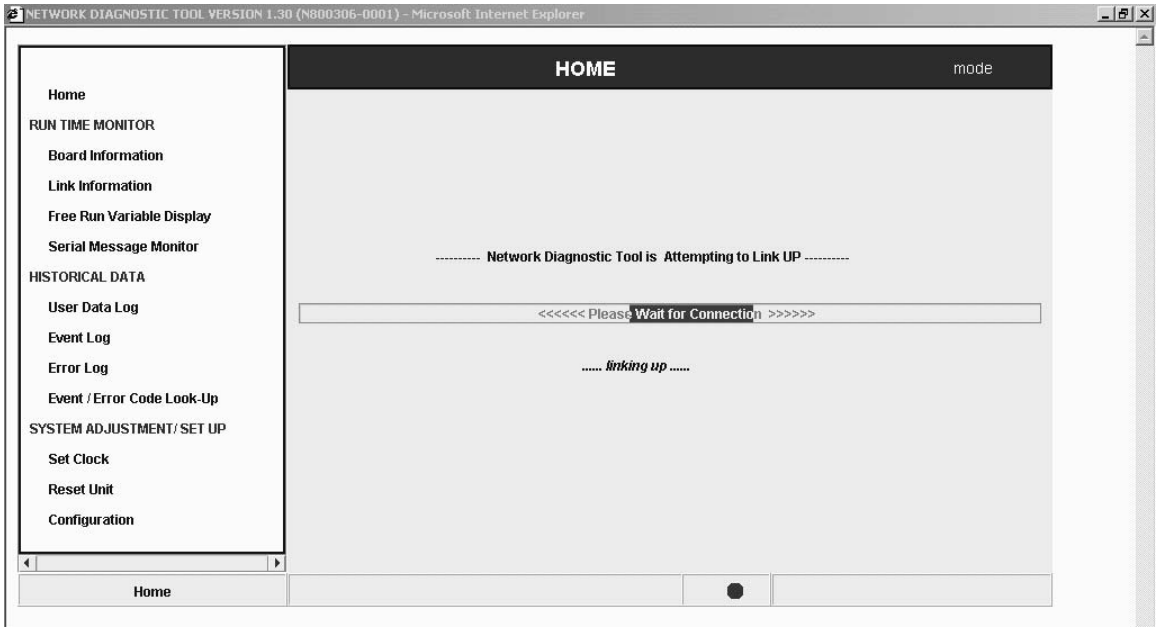


Figure 10-3. Network Diagnostic Tool – Connection Screen

Once connected the Network Diagnostic Toll Main Menu appears (See Figure 10-4).

10.3. Main Menu

NOTE

If you can not determine the version of the Executive Software being used on the OC, use the Network Diagnostic Tool to verify the version being used.

This menu displays tools available for maintaining the OC. Ensure that the Program Name is showing the anticipated program information (See Figure 10-4). This indicates a PC Link is established.

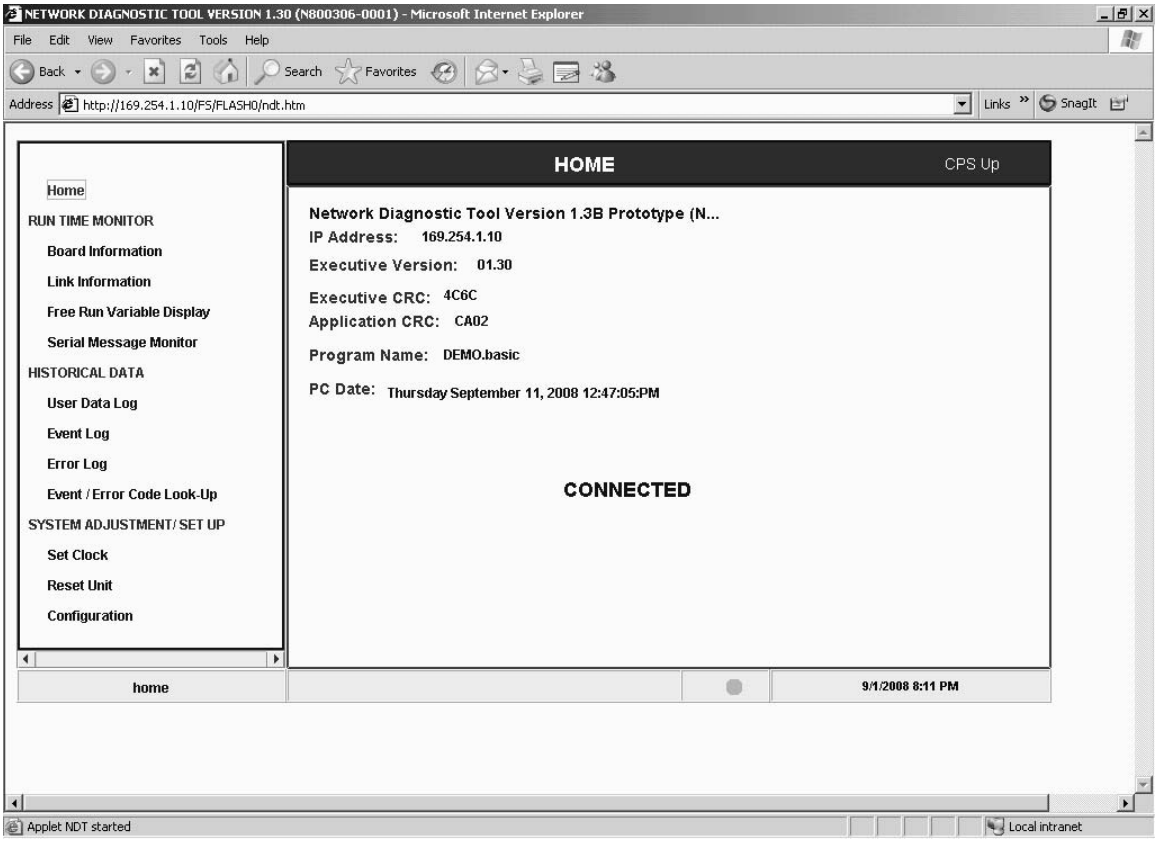


Figure 10-4. Network Diagnostic Tool System Main Menu

10.4. Run Time Monitor

10.4.1. Board Information

The Board Information Display (Figure 10-5) presents the status information about I/O boards that are enabled. I/O Boards are defined in the application logic. They may also be Enabled/Disabled during the configuration process if the I/O boards are defined as Adjustable.

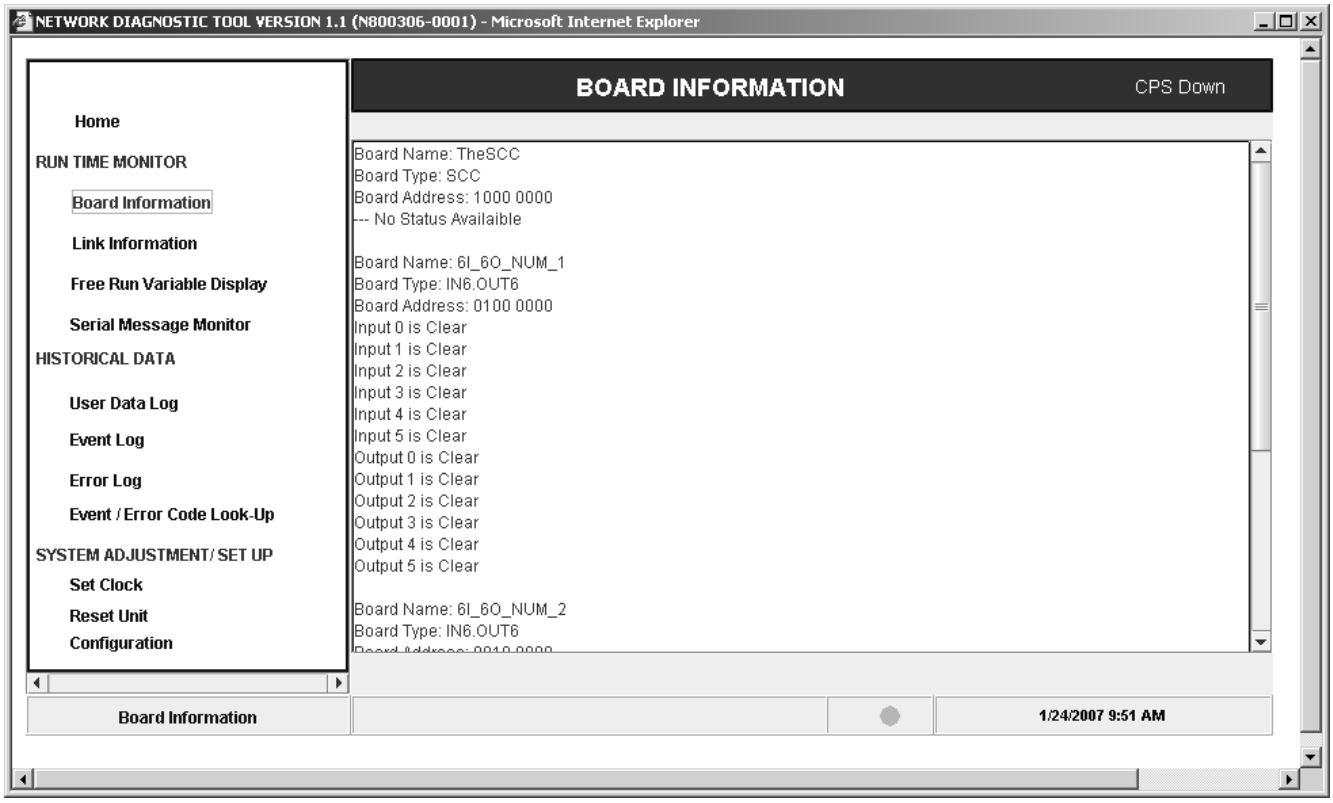


Figure 10-5. Board Information Display

10.4.2. Link Information

The Link Information Display (Figure 10-6) presents the status information about the Communication Links that are enabled. Communication Links, or Serial Links are defined in the application logic. They may also be Enabled/Disabled during the configuration process if the Serial Links are defined as Adjustable.

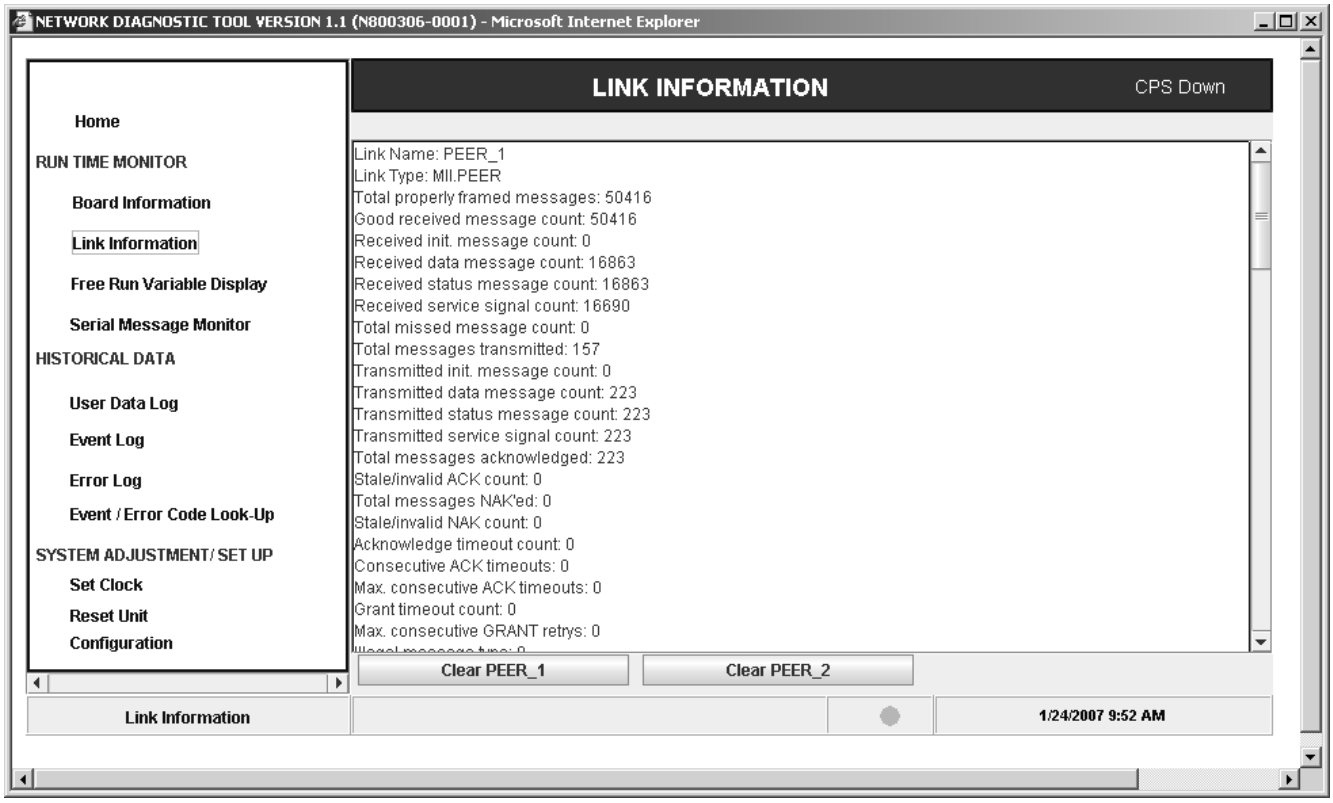


Figure 10-6. Link Information Display

10.4.2.1. Clear Link Statistics

The Network Diagnostic Tool has the ability to clear the accumulated statistics for a particular Communication Link. Below the displayed Communication Link(s) statistics are buttons to clear the defined links. By clicking on the clear button, the Network Diagnostic Tool will communicate with the OC to reset all statistics associated with said link to 0 (Figure 10-7). Once this is done the user cannot retrieve the previous statistics.

Figure 10-7. Clear Link Statistics

10.4.3. Free Run Variable Display

The Free Run Display (Figure 10-8) lists the current values for selected variables and bits as well as a real-time list of changes.

The values for all variables and bits are shown next to the variable. The scrolling text represents real-time changes.

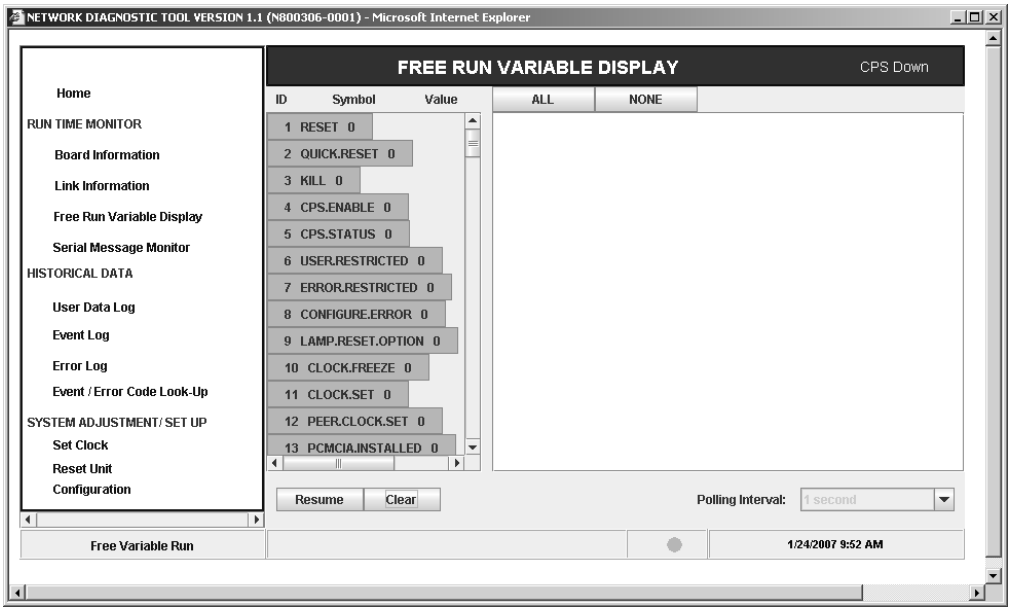


Figure 10-8. Free Run Variable Display

10.4.3.1. Variable/Bit Filtering

To view system variables in the text mode, click on the Free-run Variable Display button on the Network Diagnostic Tool menu (found on the left hand column). The free-running variable display provides a list of variables and bits with a text-based description of each variable's current status.

The user specifies which variables or bits are to be monitored. There are two ways to do this:

1. Click on the All button. The system moves all of the listed variables and bits to a point above the end of active symbols line. Any variables and bits listed above this line are monitored and dynamically updated by the program; variables or bits listed below this line are not dynamically updated.
2. Move individual variables/bits or blocks of variables/bits to a point above the end of active symbols line. To execute this double-click on the variable or bit name. This will cause the variable to be added to the list of current filtered variables to be monitored (Figure 10-9).

There are two ways to remove variables/bits from the filtered list:

1. Double click on the variable/bit name. This will move the selected variable or bit to a point below the end of the active symbols.
2. Click on the None button. The system moves all of the listed variables and bits to a point below the end of active symbols.

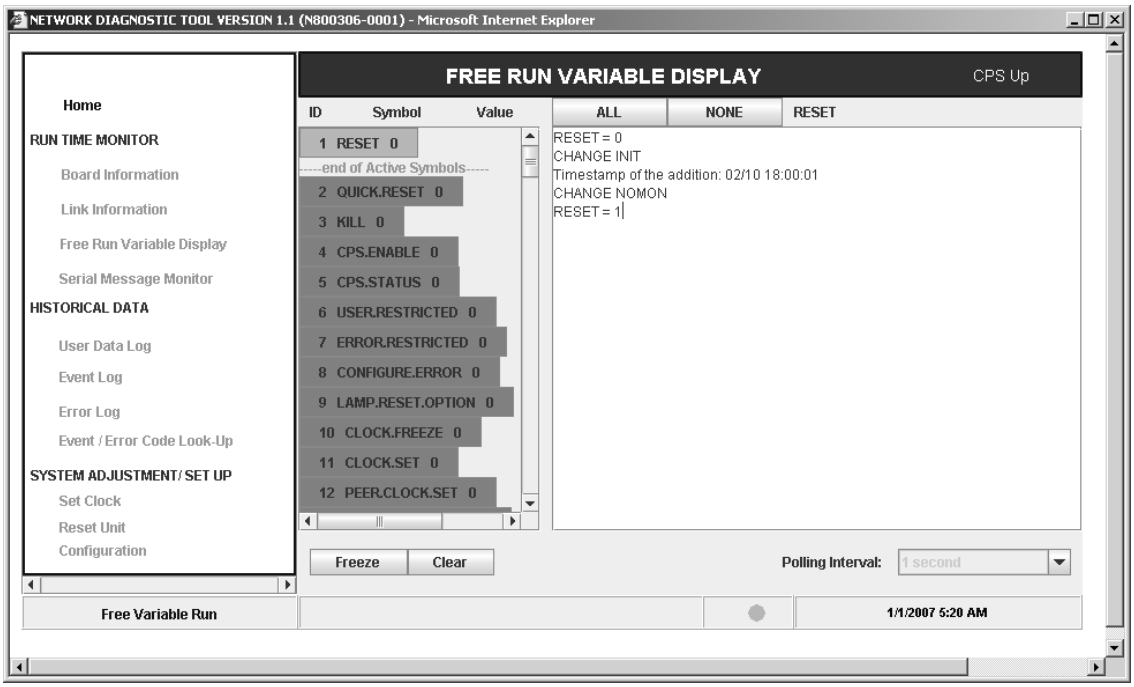


Figure 10-9. Filtered Free Run Variable Display

The Freeze/Resume and Clear buttons at the bottom of the display window affect the displayed data for all of the monitored variables:

- **Freeze** prevents all of the variables' data from updating. This feature gives you a snapshot of the variable status. After you have paused the display, the Freeze button changes to Resume. You then can click on the Resume button to resume the dynamic updating of the variable/bit data.

  The Freeze button also stops the real time scrolling text and allows the user to scroll up and down in the text. This allows the user to easily view the text without constantly updating the data populating the display.

- **Clear** removes all of the currently displayed information from the screen and restarts the updating process. The selected variables/bits in the list remain unchanged.

10.4.4. Serial Message Monitor

This function enables you to monitor serial message traffic on a selected active serial link. To monitor serial message traffic, click on "Serial Message Monitor" on the Other Tools main menu.

The system displays the Serial Message Monitor as shown in Figure 10-10.

Select an enabled serial link to monitor from the list on the left, and begin monitoring by clicking on the "Start" button. Message traffic sent and received on the serial link will begin appearing on the right side of the serial monitor screen as it is sent/received. The display will show the approximate time the message was sent/received, the message type, and the message content in hexadecimal bytes.

Messages sent by the monitored link and received messages addressed to the monitor link will display in their entirety. Only header and address information will be displayed for messages addressed to other units on the communications link. The message display may be stopped for study or review by clicking on the "Stop" button.

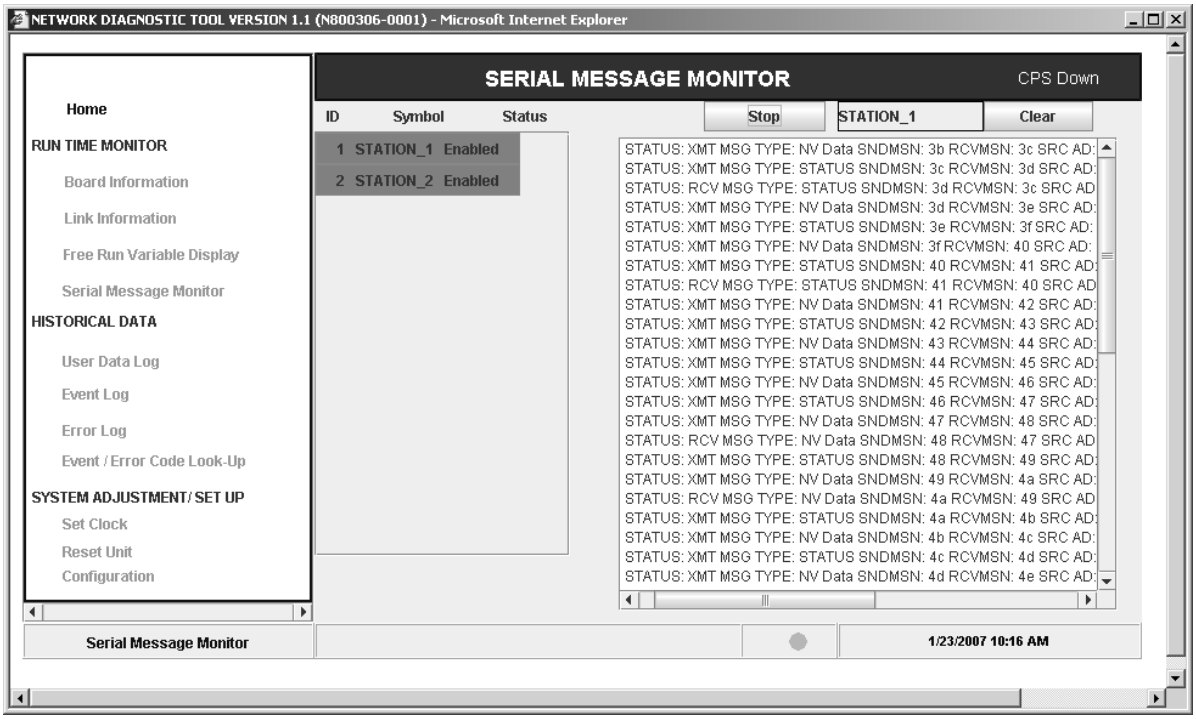

NETWORK DIAGNOSTIC TOOL VERSION 1.1 (N800306-0001) - Microsoft Internet Explorer
Home
RUN TIME MONITOR
Board Information
Link Information
Free Run Variable Display
Serial Message Monitor
HISTORICAL DATA
User Data Log
Event Log
Error Log
Event / Error Code Look-Up
SYSTEM ADJUSTMENT/ SET UP
Set Clock
Reset Unit
Configuration
SERIAL MESSAGE MONITOR
CPS Down
ID
Symbol
Status
Stop
STATION_1
Clear
1 STATION_1 Enabled
2 STATION_2 Enabled
STATUS: XMT MSG TYPE: NV Data SNDMSN: 3b RCVMSN: 3c SRC AD:
STATUS: XMT MSG TYPE: STATUS SNDMSN: 3c RCVMSN: 3d SRC AD:
STATUS: RCV MSG TYPE: STATUS SNDMSN: 3d RCVMSN: 3c SRC AD
STATUS: XMT MSG TYPE: NV Data SNDMSN: 3d RCVMSN: 3e SRC AD:
STATUS: XMT MSG TYPE: STATUS SNDMSN: 3e RCVMSN: 3f SRC AD:
STATUS: XMT MSG TYPE: NV Data SNDMSN: 3f RCVMSN: 40 SRC AD:
STATUS: XMT MSG TYPE: STATUS SNDMSN: 40 RCVMSN: 41 SRC AD:
STATUS: RCV MSG TYPE: STATUS SNDMSN: 41 RCVMSN: 40 SRC AD
STATUS: XMT MSG TYPE: NV Data SNDMSN: 41 RCVMSN: 42 SRC AD:
STATUS: XMT MSG TYPE: STATUS SNDMSN: 42 RCVMSN: 43 SRC AD:
STATUS: XMT MSG TYPE: NV Data SNDMSN: 43 RCVMSN: 44 SRC AD:
STATUS: XMT MSG TYPE: STATUS SNDMSN: 44 RCVMSN: 45 SRC AD:
STATUS: XMT MSG TYPE: NV Data SNDMSN: 45 RCVMSN: 46 SRC AD:
STATUS: XMT MSG TYPE: STATUS SNDMSN: 46 RCVMSN: 47 SRC AD:
STATUS: XMT MSG TYPE: NV Data SNDMSN: 47 RCVMSN: 48 SRC AD:
STATUS: RCV MSG TYPE: NV Data SNDMSN: 48 RCVMSN: 47 SRC AD
STATUS: XMT MSG TYPE: STATUS SNDMSN: 48 RCVMSN: 49 SRC AD:
STATUS: XMT MSG TYPE: NV Data SNDMSN: 49 RCVMSN: 4a SRC AD:
STATUS: RCV MSG TYPE: NV Data SNDMSN: 4a RCVMSN: 49 SRC AD
STATUS: XMT MSG TYPE: STATUS SNDMSN: 4a RCVMSN: 4b SRC AD:
STATUS: XMT MSG TYPE: NV Data SNDMSN: 4b RCVMSN: 4c SRC AD:
STATUS: XMT MSG TYPE: STATUS SNDMSN: 4c RCVMSN: 4d SRC AD:
STATUS: XMT MSG TYPE: NV Data SNDMSN: 4d RCVMSN: 4e SRC AD:
Serial Message Monitor
1/23/2007 10:16 AM

Figure 10-10. Serial Message Monitor

The display may be scrolled up and down or left and right to view the complete contents on the screen. Clicking on the "Start" button again restarts the monitor display. Clicking on the "Clear" button clears the display.

10.5. Historical Data

These links lead to views, which display data which an operating OC has collected and stored.

10.5.1. User Data Log

10.5.1.1. User Data Log Display

The User Data Log (Figure 10-11) displays changes of selected bit and numeric variables as requested by the application or configuration.

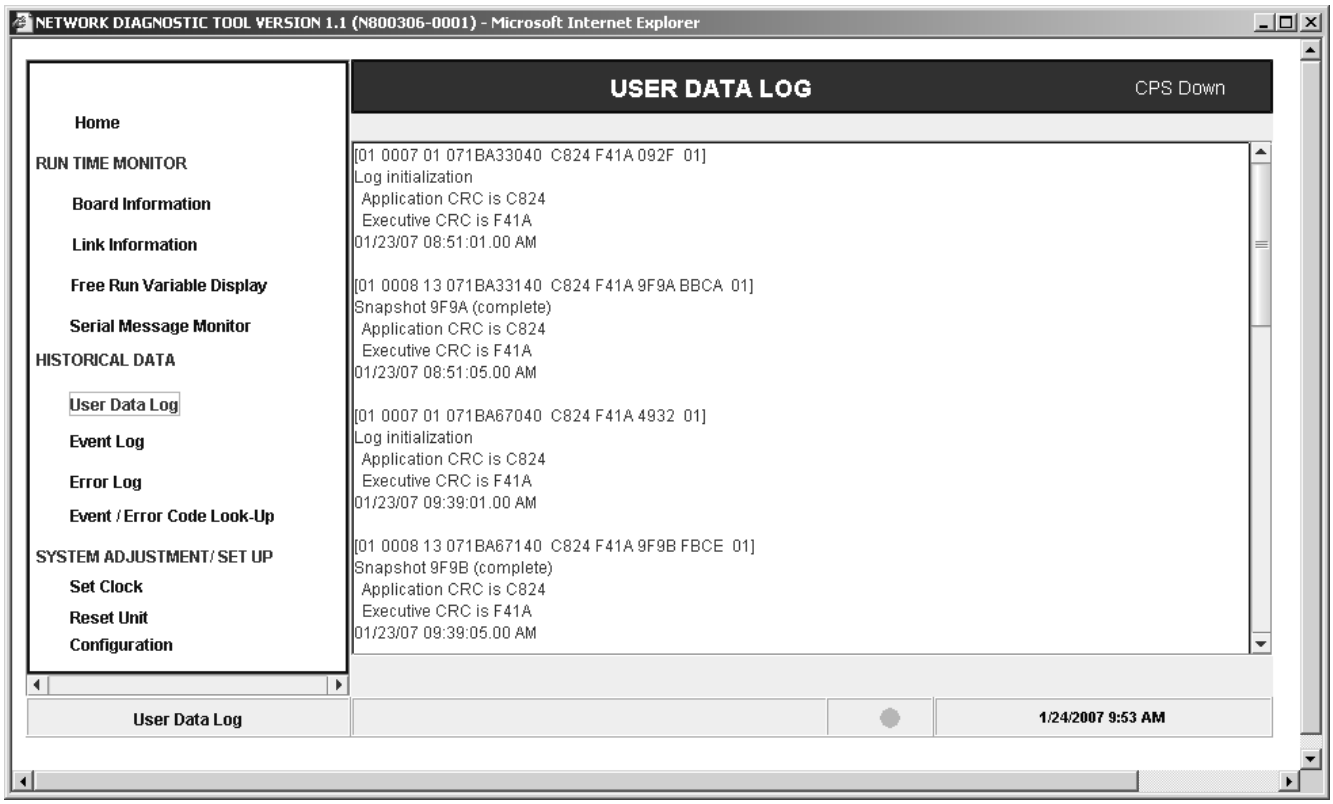


Figure 10-11. User Data Log

10.5.2. System Event Log

10.5.2.1. Event Screen

The System Event Log (Figure 10-12) displays the most recent 5000 critical errors, warnings or events saved in the System Event Log. Any system critical error or warning is logged in the System Event Log. Events are used to relay miscellaneous system information and may be limited by use of the configuration.

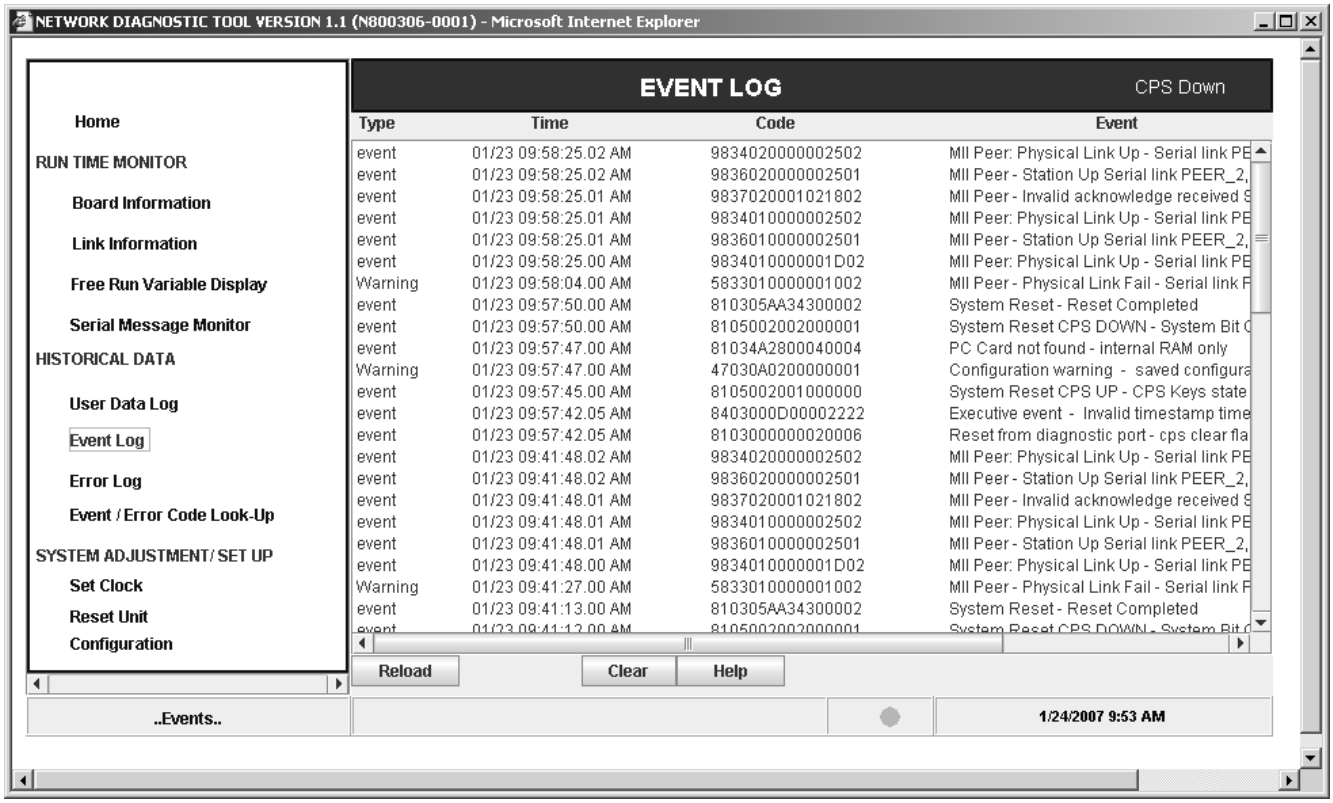

NETWORK DIAGNOSTIC TOOL VERSION 1.1 (N800306-0001) - Microsoft Internet Explorer
Home
RUN TIME MONITOR
Board Information
Link Information
Free Run Variable Display
Serial Message Monitor
HISTORICAL DATA
User Data Log
Event Log
Error Log
Event / Error Code Look-Up
SYSTEM ADJUSTMENT/ SET UP
Set Clock
Reset Unit
Configuration
EVENT LOG
CPS Down
Type
Time
Code
Event
event 01/23 09:58:25.02 AM 9834020000002502 MII Peer: Physical Link Up - Serial link PE
event 01/23 09:58:25.02 AM 9836020000002501 MII Peer - Station Up Serial link PEER_2,
event 01/23 09:58:25.01 AM 9837020001021802 MII Peer - Invalid acknowledge received S
event 01/23 09:58:25.01 AM 9834010000002502 MII Peer: Physical Link Up - Serial link PE
event 01/23 09:58:25.01 AM 9836010000002501 MII Peer - Station Up Serial link PEER_2,
event 01/23 09:58:25.00 AM 9834010000001D02 MII Peer: Physical Link Up - Serial link PE
Warning 01/23 09:58:04.00 AM 5833010000001002 MII Peer - Physical Link Fail - Serial link F
event 01/23 09:57:50.00 AM 810305AA34300002 System Reset - Reset Completed
event 01/23 09:57:50.00 AM 8105002002000001 System Reset CPS DOWN - System Bit C
event 01/23 09:57:47.00 AM 81034A2800040004 PC Card not found - internal RAM only
Warning 01/23 09:57:47.00 AM 47030A0200000001 Configuration warning - saved configura
event 01/23 09:57:45.00 AM 8105002001000000 System Reset CPS UP - CPS Keys state
event 01/23 09:57:42.05 AM 8403000D00002222 Executive event - Invalid timestamp time
event 01/23 09:57:42.05 AM 8103000000020006 Reset from diagnostic port - cps clear fla
event 01/23 09:41:48.02 AM 9834020000002502 MII Peer: Physical Link Up - Serial link PE
event 01/23 09:41:48.02 AM 9836020000002501 MII Peer - Station Up Serial link PEER_2,
event 01/23 09:41:48.01 AM 9837020001021802 MII Peer - Invalid acknowledge received S
event 01/23 09:41:48.01 AM 9834010000002502 MII Peer: Physical Link Up - Serial link PE
event 01/23 09:41:48.01 AM 9836010000002501 MII Peer - Station Up Serial link PEER_2,
event 01/23 09:41:48.00 AM 9834010000001D02 MII Peer: Physical Link Up - Serial link PE
Warning 01/23 09:41:27.00 AM 5833010000001002 MII Peer - Physical Link Fail - Serial link F
event 01/23 09:41:13.00 AM 810305AA34300002 System Reset - Reset Completed
Reload
Clear
Help
..Events..
1/24/2007 9:53 AM

Figure 10-12. System Event Log

10.5.2.2. Reload Button

Click the Reload button to refresh the display with the current event data stored on the OC.

10.5.2.3. Clear Button

Click the Clear button to clear the system event log. A confirmation dialog box appears.

10.5.2.4. Save Log

Saving the logs to the local PC can be achieved in the following manner:

- Click in the logged data text area
- Enter Control + A on the keyboard to select all the text
- Enter Control + C to copy the selected text
- Open a text editor (i.e., Notepad or Wordpad)
- With the text editor opened, enter Control + V on the keyboard to paste the text

- To save the text file, enter Control + S on the keyboard
- Select the location and filename and click Save

10.5.2.5. Help Button

This link leads to a view (Figure 10-13) in which the user enters a 16-digit hex event or error code number and receives help information. The help text is a detailed description of the event or error.

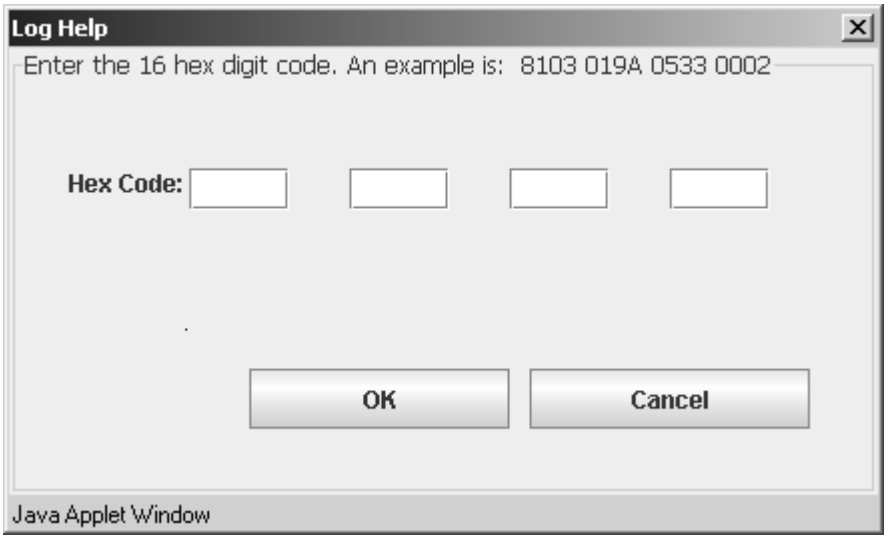


Figure 10-13. Help Button Window

10.5.3. System Error Log

Since the older events may be lost, the System Error Log (Figure 10-14) contains a list of the last fifty time stamped system critical errors. The System Error Log follows the same rules as the System Event Log, but is limited to critical errors.

This view has the exact same functionality as the System Event Log View, except for the Clear Log feature.

The display lists the most recent fify critical errors saved in the System Error Log. Click the reload button to refresh the display with the current error data stored on the OC.

Note that no Clear button exists for this log. The System Error Log cannot be cleared because it contains important error information which should not be deleted. To get help on any particular error, highlight the time of the error by clicking on it and then press the Help button. A help box on that error will appear.

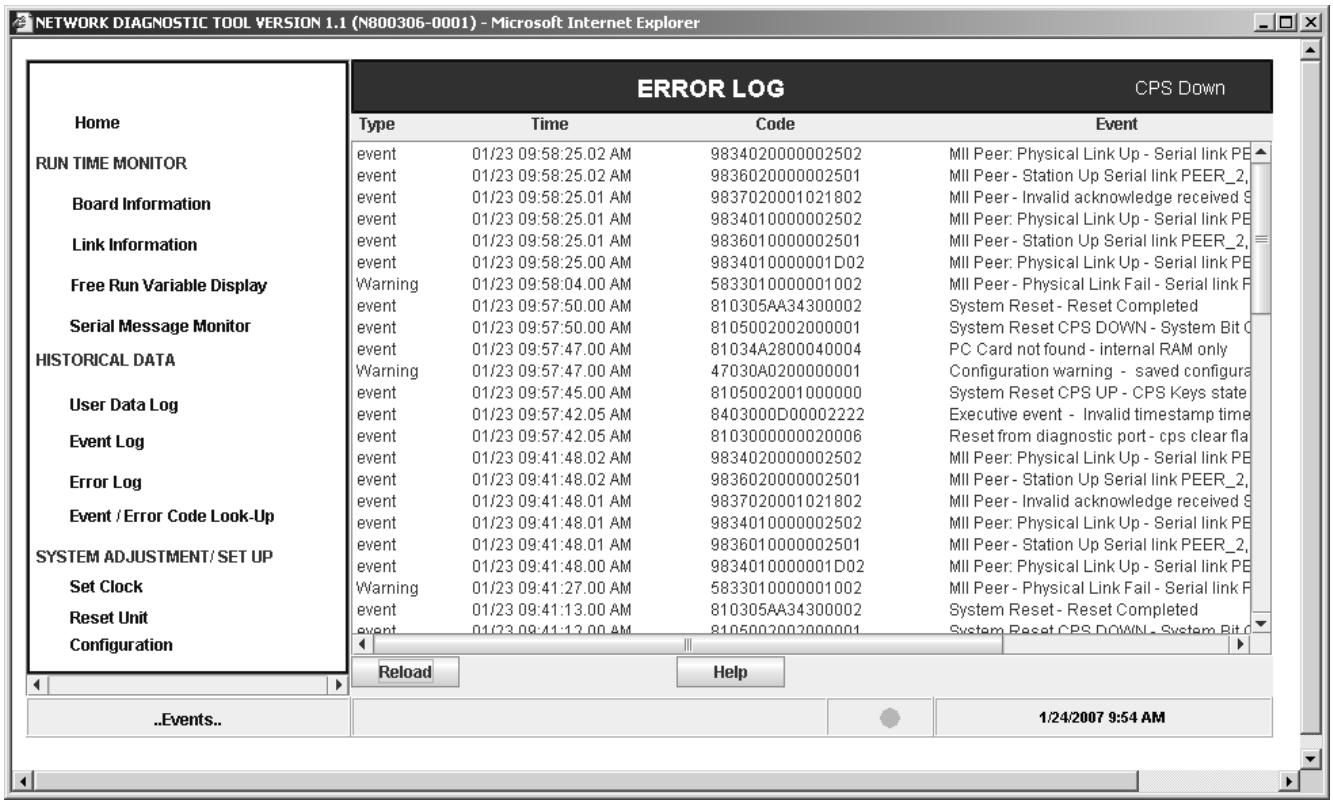

NETWORK DIAGNOSTIC TOOL VERSION 1.1 (N800306-0001) - Microsoft Internet Explorer
Home
RUN TIME MONITOR
Board Information
Link Information
Free Run Variable Display
Serial Message Monitor
HISTORICAL DATA
User Data Log
Event Log
Error Log
Event / Error Code Look-Up
SYSTEM ADJUSTMENT/ SET UP
Set Clock
Reset Unit
Configuration
ERROR LOG
CPS Down
Type Time Code Event
event 01/23 09:58:25.02 AM 9834020000002502 MII Peer: Physical Link Up - Serial link PE
event 01/23 09:58:25.02 AM 9836020000002501 MII Peer - Station Up Serial link PEER_2,
event 01/23 09:58:25.01 AM 9837020001021802 MII Peer - Invalid acknowledge received S
event 01/23 09:58:25.01 AM 9834010000002502 MII Peer: Physical Link Up - Serial link PE
event 01/23 09:58:25.01 AM 9836010000002501 MII Peer - Station Up Serial link PEER_2,
event 01/23 09:58:25.00 AM 9834010000001D02 MII Peer: Physical Link Up - Serial link PE
Warning 01/23 09:58:04.00 AM 5833010000001002 MII Peer - Physical Link Fail - Serial link F
event 01/23 09:57:50.00 AM 810305AA34300002 System Reset - Reset Completed
event 01/23 09:57:50.00 AM 8105002002000001 System Reset CPS DOWN - System Bit C
event 01/23 09:57:47.00 AM 81034A2800040004 PC Card not found - internal RAM only
Warning 01/23 09:57:47.00 AM 47030A0200000001 Configuration warning - saved configura
event 01/23 09:57:45.00 AM 8105002001000000 System Reset CPS UP - CPS Keys state
event 01/23 09:57:42.05 AM 8403000D00002222 Executive event - Invalid timestamp time
event 01/23 09:57:42.05 AM 8103000000020006 Reset from diagnostic port - cps clear fla
event 01/23 09:41:48.02 AM 9834020000002502 MII Peer: Physical Link Up - Serial link PE
event 01/23 09:41:48.02 AM 9836020000002501 MII Peer - Station Up Serial link PEER_2,
event 01/23 09:41:48.01 AM 9837020001021802 MII Peer - Invalid acknowledge received S
event 01/23 09:41:48.01 AM 9834010000002502 MII Peer: Physical Link Up - Serial link PE
event 01/23 09:41:48.01 AM 9836010000002501 MII Peer - Station Up Serial link PEER_2,
event 01/23 09:41:48.00 AM 9834010000001D02 MII Peer: Physical Link Up - Serial link PE
Warning 01/23 09:41:27.00 AM 5833010000001002 MII Peer - Physical Link Fail - Serial link F
event 01/23 09:41:13.00 AM 810305AA34300002 System Reset - Reset Completed
Reload
Help
..Events..
1/24/2007 9:54 AM

Figure 10-14. System Error Log

10.6. System Adjustment/Setup

10.6.1. Set Clock

This link sets the clock on the OC using the current PC time or a user specified time.

10.6.1.1. Set Time of Day Clock

The Set Time of Day Clock Display (Figure 10-15) sets the OC's clock.

Select the time of day either from the PC clock or from the time entered manually by the user. Click on the "Set Time" link to transmit the time to the OC. The date and time format is MM/DD/YY HH:MM:SS (AM/PM) where M is month, D is day, Y is year, H is hour, M is minute and S is second. An example is 01/01/00 2:05:00 PM which represents January 1st, 2000 at 2:05 PM in the afternoon.

Since the OC's internal clock provides the date stamping information for all logging functions it is important that its accuracy be checked routinely.

Ensure that the clock is set correctly after:

- All Resets
- After software upload or download
- After time changes (daylight savings time)
- After CPS failures
- Once a month as maintenance

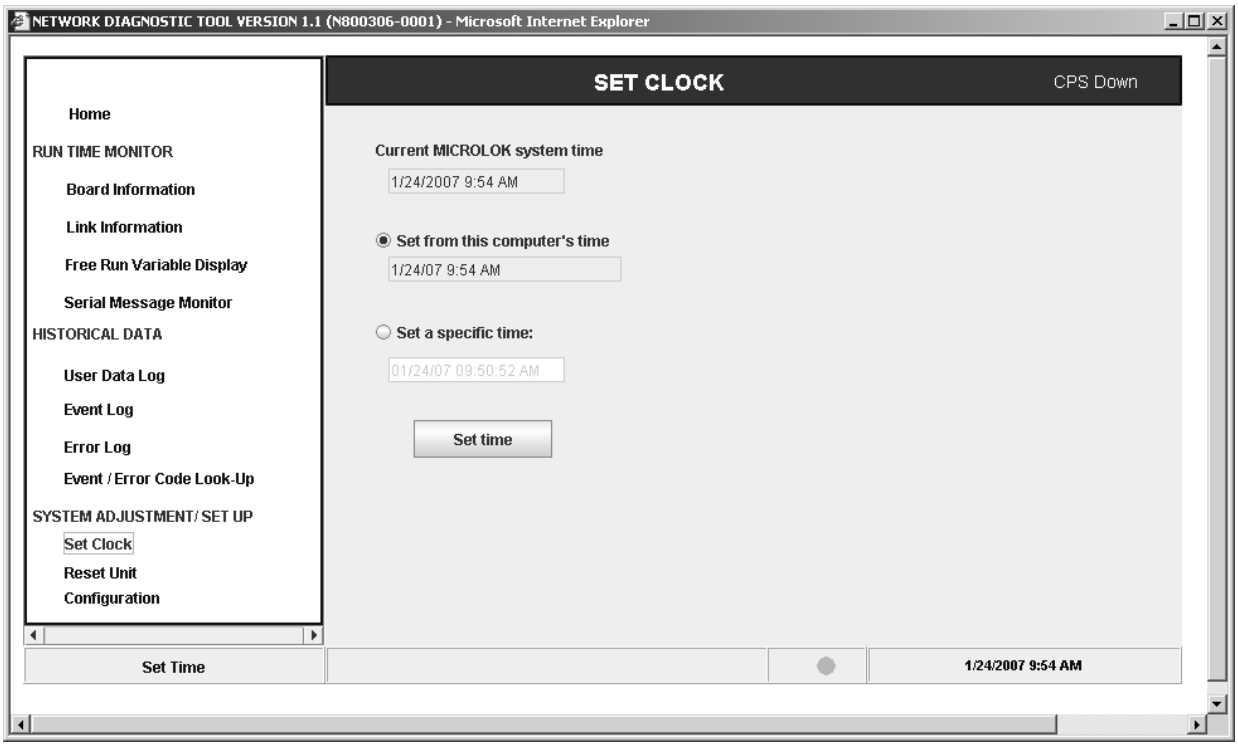


Figure 10-15. Set Time of Day Clock Display

10.6.2. Reset MICROLOK Object Controller

The Reset Unit link resets the OC identical to a manual CPU push button reset. Pressing the Reset OC link results in the screen shown in Figure 10-16.

OC units with vital outputs employ a CPS to control the connection of the battery to the outputs. The Network Diagnostic Tool will display the screen shown in Figure 10-17 when the OC unit is in normal operation. Note the "CPS Up" display in the top right corner of the screen.

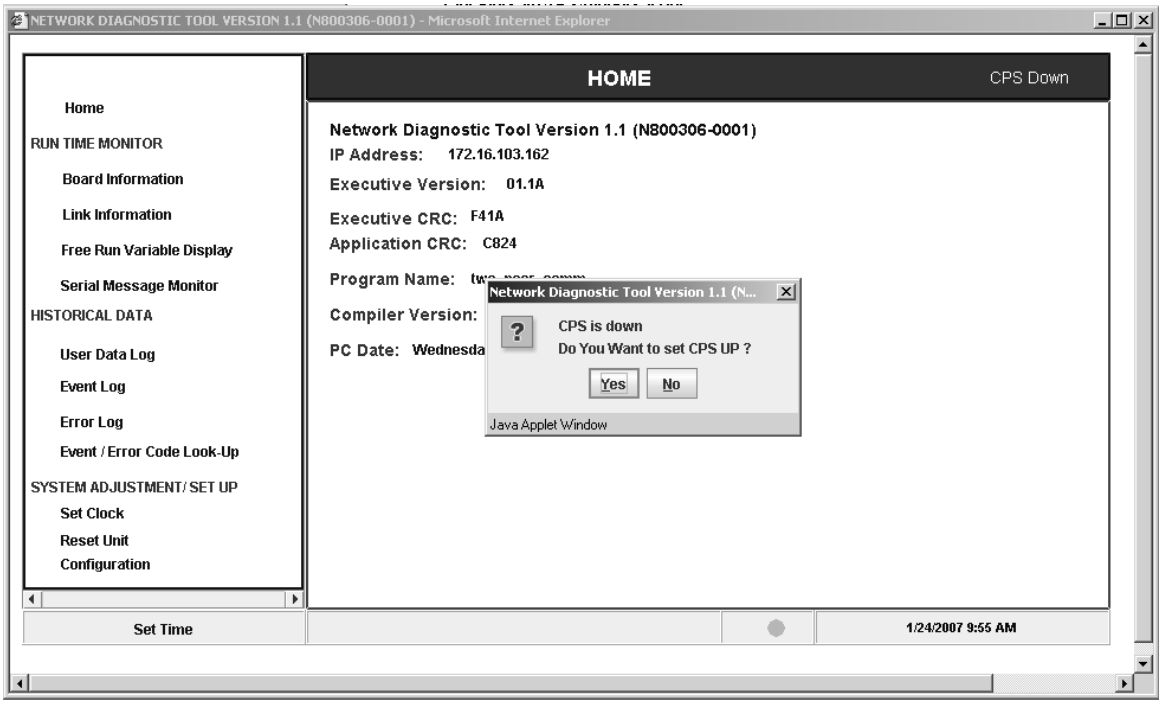


Figure 10-16. Object Controller Reset Dialog Box

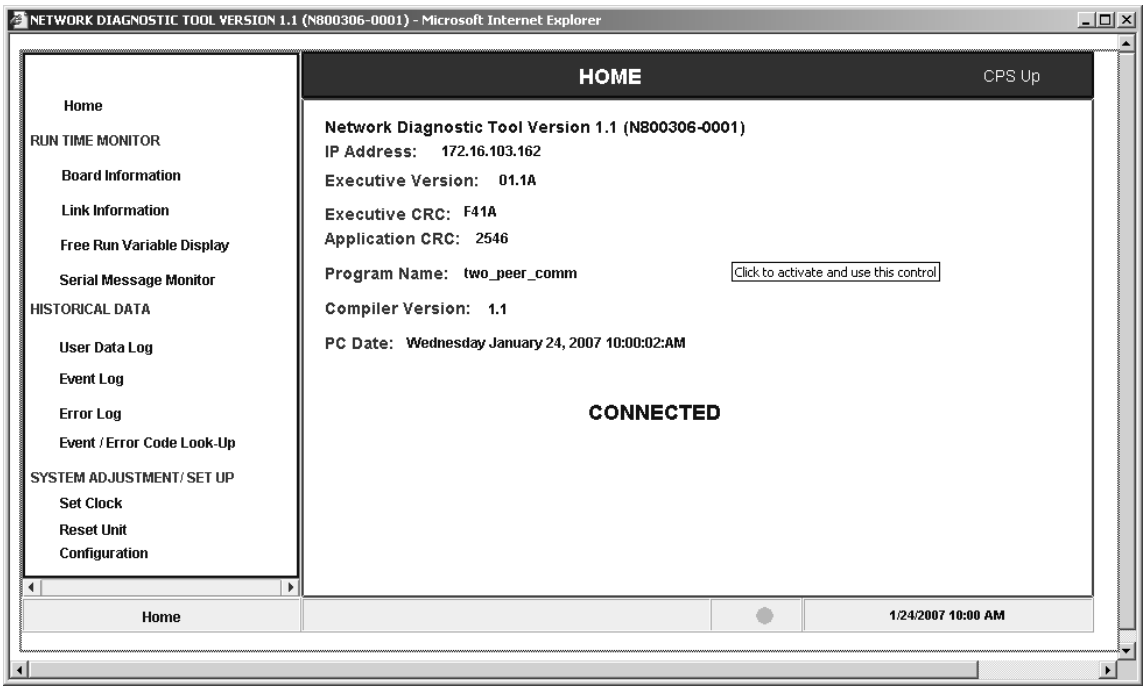


Figure 10-17. Typical Main Screen with Unit in CPS Up Mode

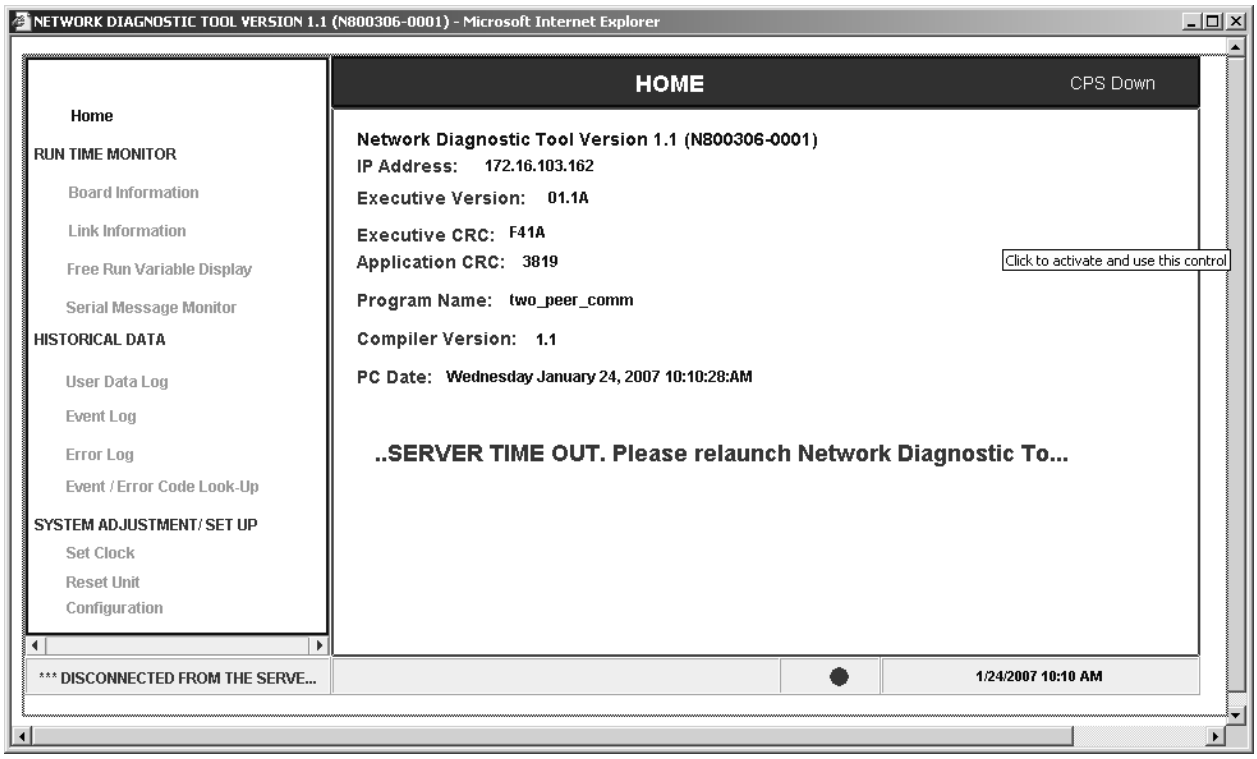


Figure 10-18. Time Out Window

If there is no network communication within a timeout period, then the connection to the Network Interface closes, refer toFigure 10-18. This is done to ensure that an idle PC does not cause a denial of service, so another PC can then connect to the Network Interface. This timeout (360 seconds) is specified in the Network Interface configuration file niacfg.ini, under option CLIENT_TIME_OUT.

To reconnect, close the Network Diagnostic Tool and the Network Interface windows. Then reconnect to the Network Interface window and relaunch the Network Diagnostic Tool.

A reset of the OC unit is required whenever configuration changes are made or when the unit has detected critical errors and gone into Shutdown Mode (Figure 10-19).

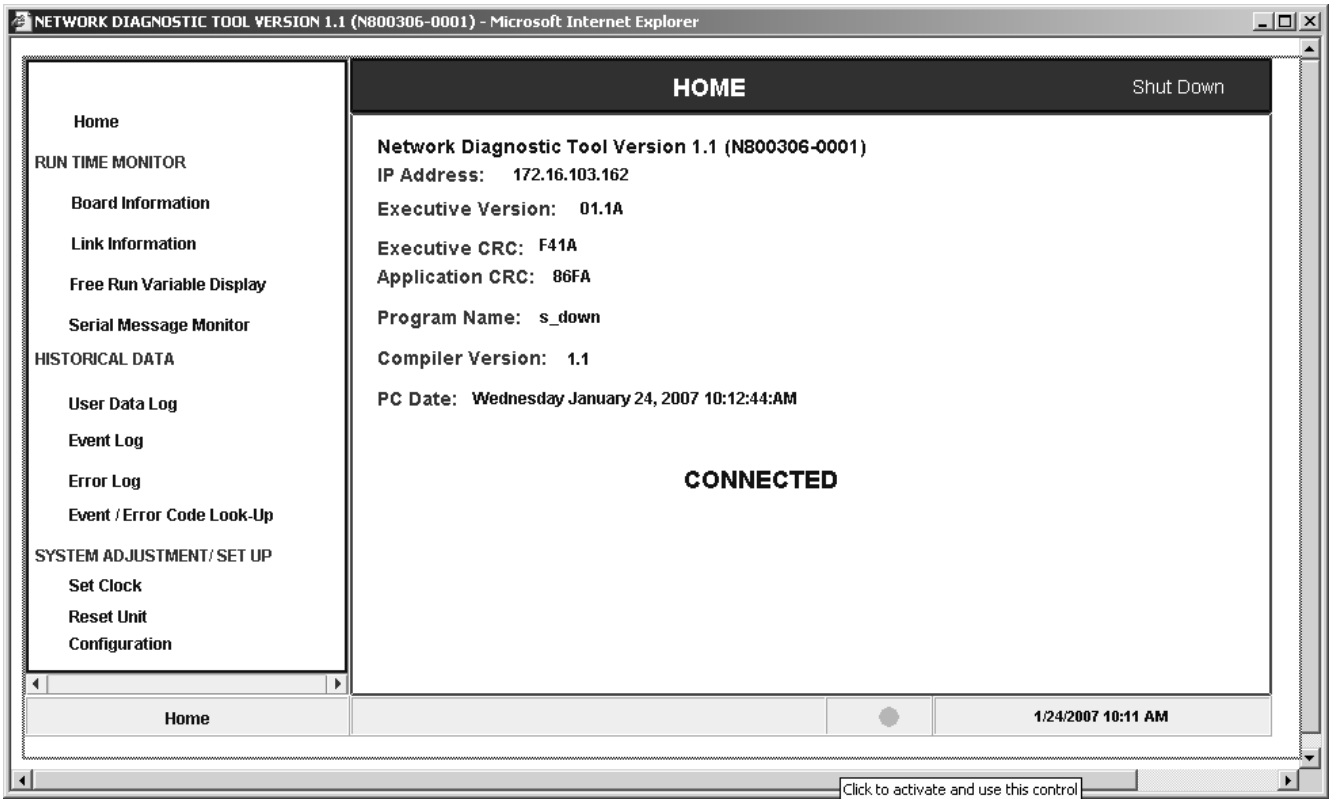


Figure 10-19. Typical Main Screen with Unit in Shutdown Mode

10.6.3. System Configuration

This function allows the user to change configurable parameters. A password is required to modify parameters.

NOTE

When configuring OC part number N17700119, make sure the write-enable adapter is connected between the dongle and the front panel serial port.

The dialog box shown in Figure 10-20 appears after the user clicks the System Configuration link on the main menu on the left side of the screen. This dialog presents the user with a password entry text box. The System Configuration allows the user to view and make changes to the vital and non-vital settings of boards and links. The program does not allow access to modifications of configuration values without the correct password.

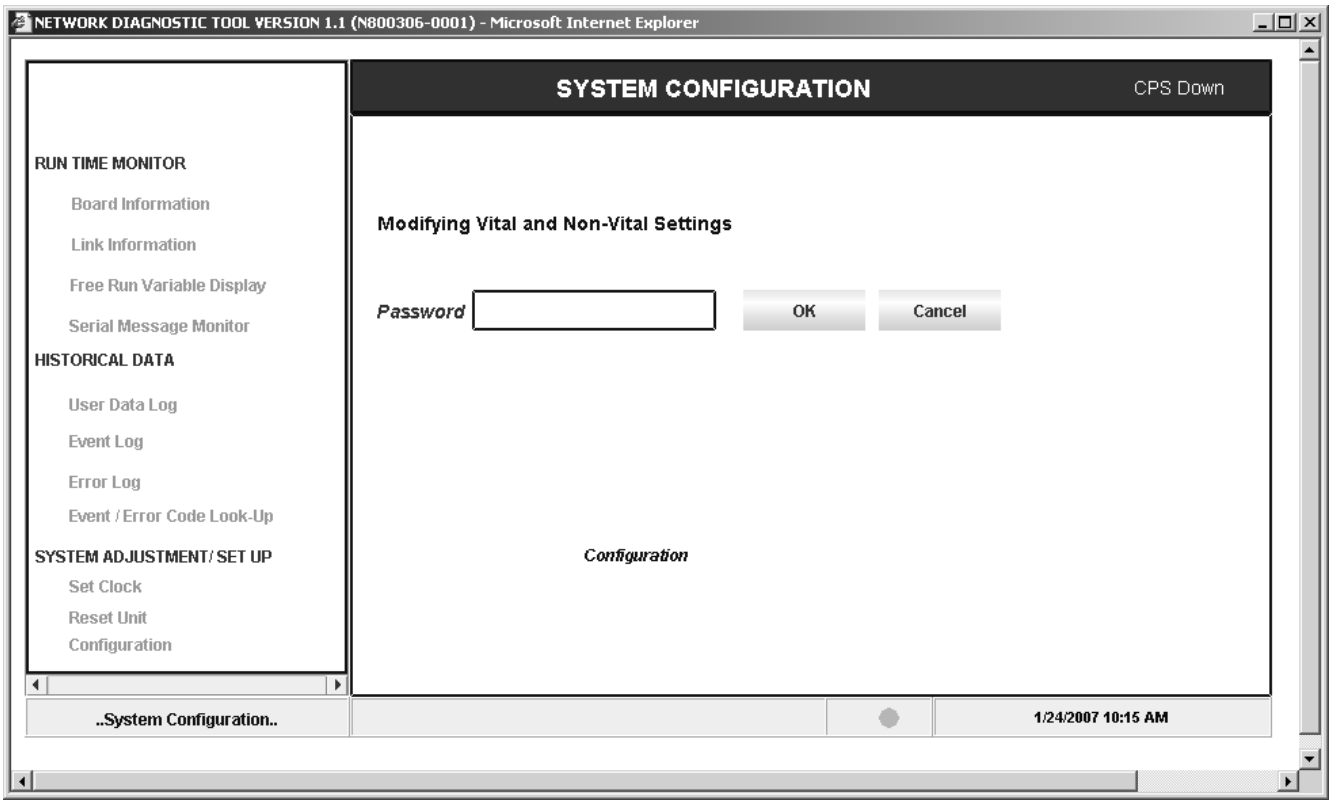


Figure 10-20. System Configuration Dialog Box

10.6.3.1. Configuring the MICROLOK Object Controller System

10.6.3.1.1. Procedure to Access the System Configuration Options

Click on the System Configuration link on the Network Diagnostic Tool main menu. The system displays a password dialog box that lets the user specify whether to view or change configuration settings.

Click in the Password box and then enter the appropriate password. The default password is **microlokii** (case sensitive). If the first option, "Examine settings" is selected then the user does not need to enter a password.

The system configuration display appears on the computer screen (See Figure 10-21). This display provides direct access to all of the OC configuration options. Select from the available options to display screens that allow the user to view/modify the configuration settings for the system in general, I/O boards and communications links.

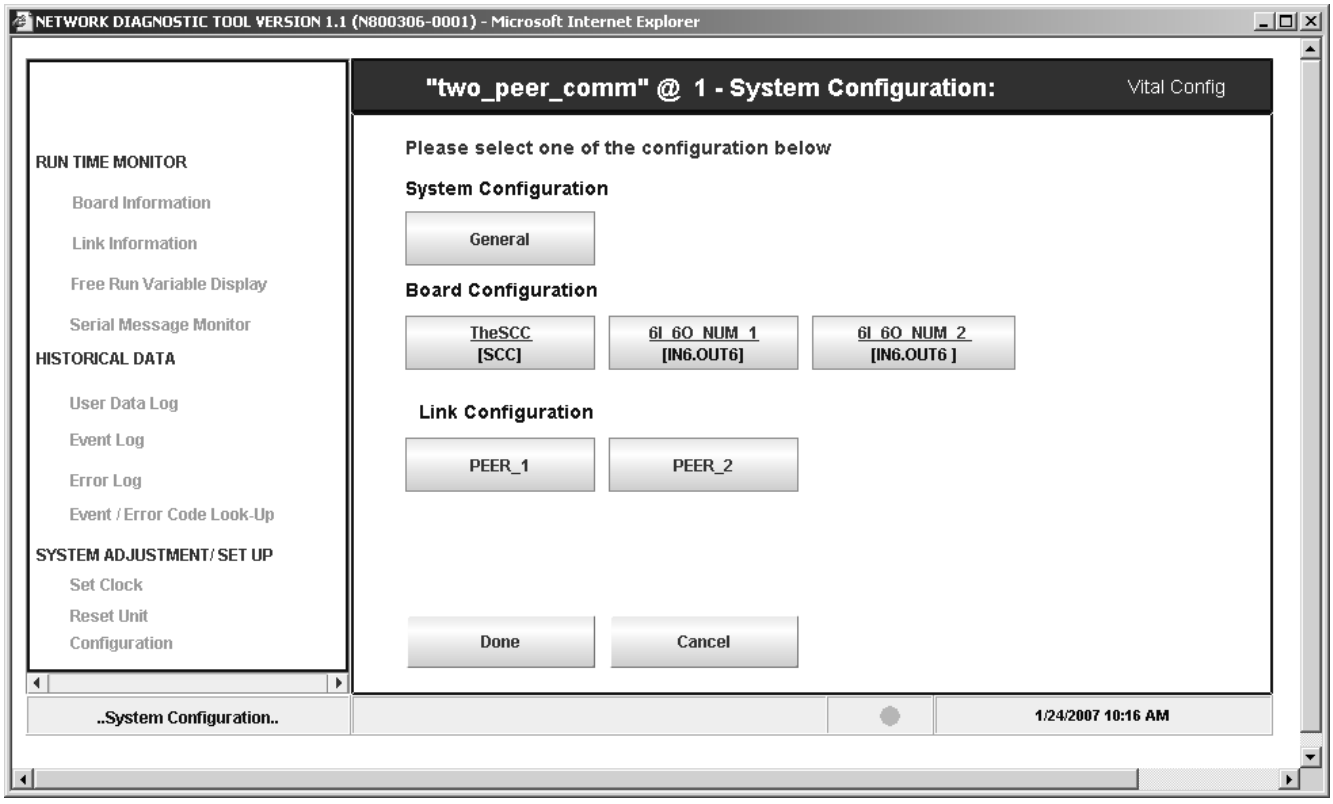


Figure 10-21. Typical System Configuration Display

10.6.3.1.2. System Configuration Overview

Configured PCBs and links appear on the main screen. If they appear grayed-out, they are currently disabled.

The configuration tool provides a wide variety of options for checking and modifying the configuration of the OC system hardware and software. Three types of options are provided within this tool:

- System Configuration options enable the user to modify the general system parameter.
- Board Configuration options enable the user to enable/disable and configure the individual OC system printed circuit boards.
- Link configuration options enable the user to configure the OC system communication links.

10.6.3.2. General System Settings

Displays system configuration and event settings.

Click on the General selection button on the system configuration selection display.

Check/adjust the general system settings on the screen shown in Figure 10-22.

The top four fields in this display show the dates on which the system vital and non-vital configuration settings were last modified. Entries are included for configurations done using the Network Diagnostic Tool program. The user cannot modify these fields.

The Event Class Logging Threshold fields are used to manage the amount of information placed in the event buffer during system operation. Each event listed on this display is a system event predefined in the OC executive software. The setting indicated for each event (1, 2, and 3 are the available options) determines the logging level for the event. Level 1 is the lowest level and logs the least amount of information. Each higher level logs all information within its own level as well as lower levels. Each error class maintains its own logging level such that different logging levels can be set for the different error classes. Events are placed in the logging levels based on sub-class.

Scroll the screen down to access the remaining configuration options on this display. The Timing parameters are set in the application program. These parameters specify delay periods in milliseconds that are used by the system during normal operation (Logic Timeout) and following a manual reset of the system (Delay Reset).

The PC Configuration fields are used to set the port address and baud rate for the OC CPU board diagnostic port. The default settings are shown to the right of the individual fields.

The Password field enables the user to change the system password. Use the Set button for this function.

After modifying the information in one or more fields, two pushbuttons near the bottom of the window become active.

The Apply Defaults button changes the data in all of the fields back to the default values as set in the application program. The default value is shown to the right of each data field.

The Reset Changes button "undoes" all the current changes so all values revert to those existing when the configuration screen was first accessed.

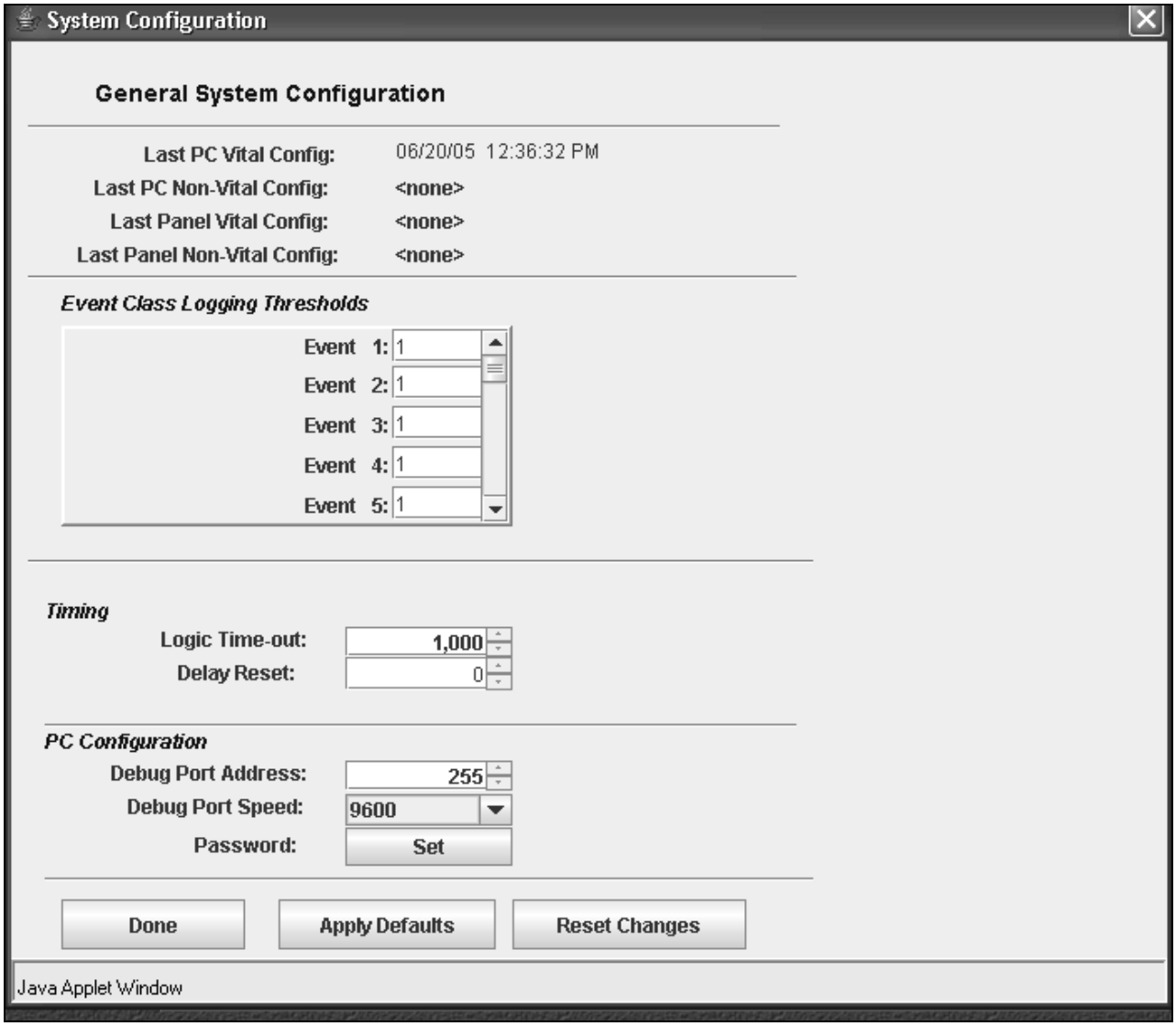


Figure 10-22. General System Configuration

NOTE

The Reset Changes option differs from Apply Defaults because the values set before the most recent changes were not necessarily the default values.

When all of the general system configuration parameters have been set to the proper values for the application, click on the Done button at the lower left corner of the screen.

Another dialog box appears. It displays that a value was changed and shows the previous value. Click on the Yes button to save the configuration changes and complete the configuration for the general system settings. The system configuration selection display is again displayed on the screen.

10.6.3.3. Board Configuration Settings

Each I/O board that is identified in the application program must be properly configured for operation.

The OC system supports the operation of several types of I/O boards. These include the SCC, MIX I/O, IN6.OUT6, IN6, and LED6 boards.

Click on one of the Board Configuration selection buttons on the system configuration selection screen. A screen similar to Figure 10-23 appears.

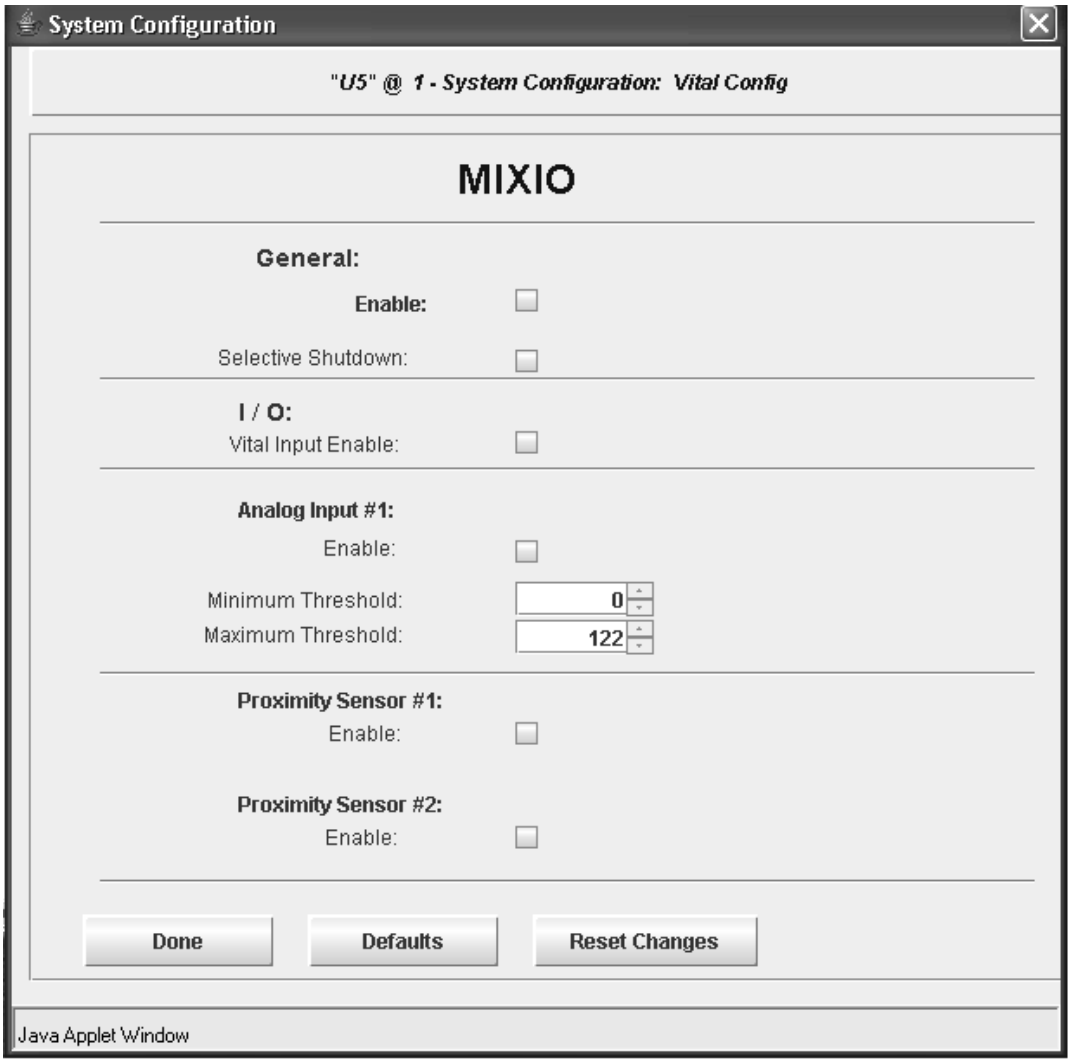


Figure 10-23. Typical MIX I/O Configuration Screen

10.6.3.4. Link Configurations

The link configuration screen is shown in Figure 10-24.

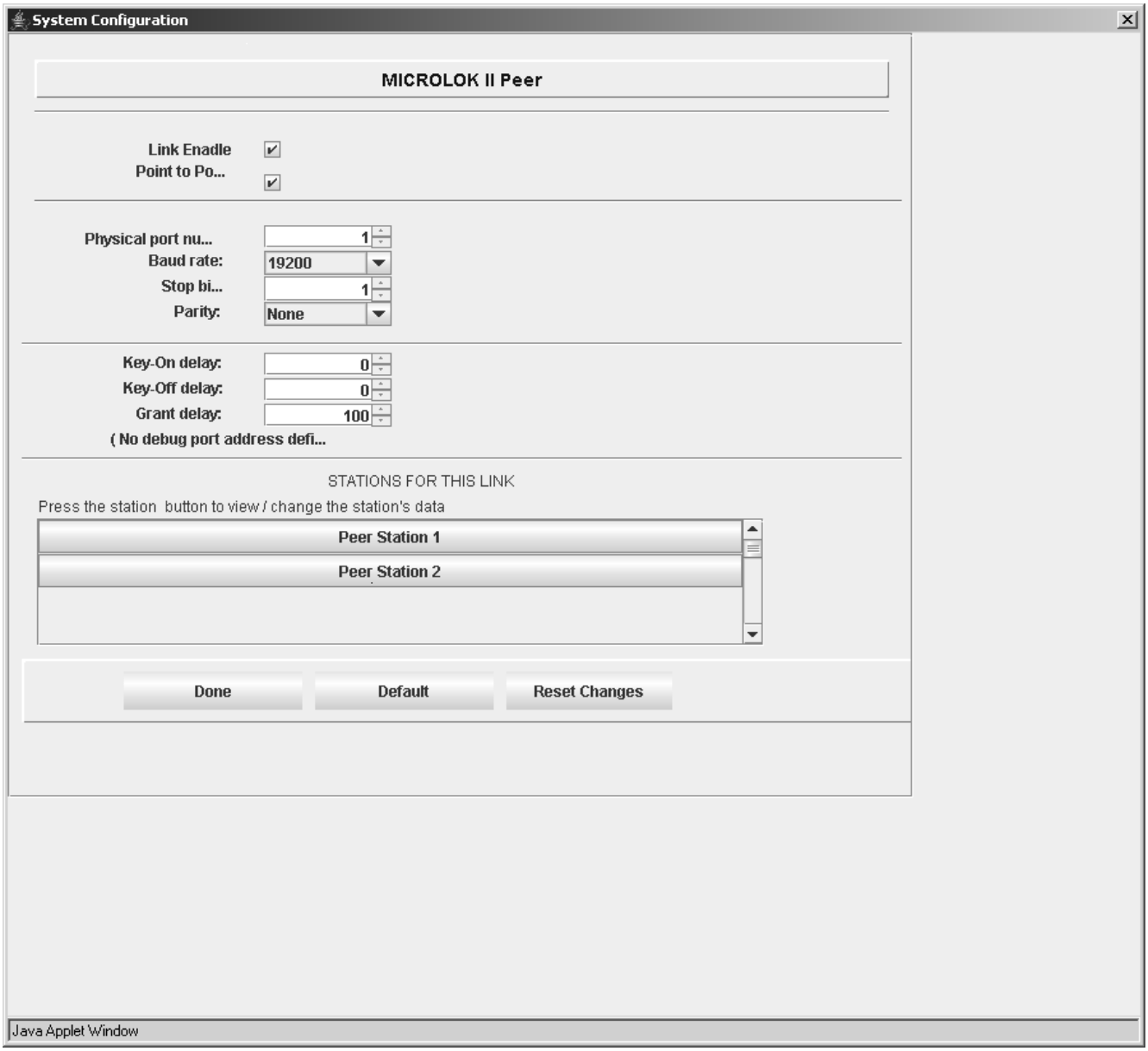


Figure 10-24. Link Configuration Screen

Each serial link that is identified in the application program must be properly configured for operation.

The OC system supports the operation of several types of serial links. These include MICROLOK, GENISYS, and PEER protocol links.

Click on one of the Link Configuration selection buttons on the system configuration selection screen. Something similar to the following appears: a link enable and point-to-point section, a physical port number, baud rate, stop bits and parity section, a key-on delay, key-off delay,

master wait timeout, polling interval, stale data timeout and configuration address section, a carrier mode, secure, CRC type and check back section, and a Station 1 enable and Station 2 enable section.

10.6.4. Event/Error Code Help

This link leads to a view in which the user enters a 16-digit hex event or error code number and receives help information (Figure 10-25). The help text is a detailed description of the event or error.

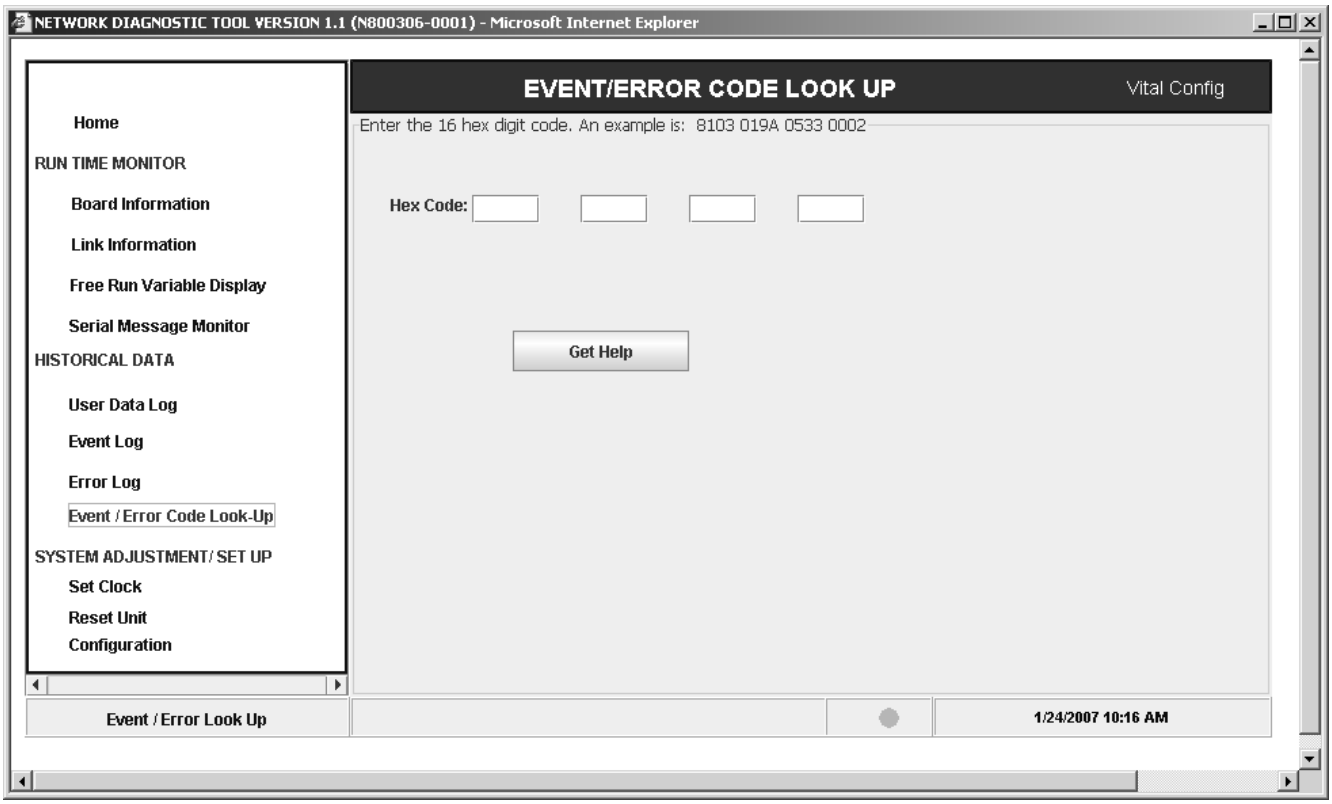


Figure 10-25. Network Diagnostic Tool Event/Error Code Help Screen

This view is used to help the user determine what an event or error code actually means in plain English. The user interface is a dialog-style entry box into which the 16-digit hex code is entered. The code is entered four digits at a time as presented in the Codes column in the Event or Error Logs. Each edit box can hold four hex digits. There are four edit boxes, therefore 4 x 4 = 16 total hex digits. Remember, valid hex digits are 0 through 9, A, B, C, D, E, and F. Anything else is illegal. Once the digits are entered, the user presses the Get Help button and help is retrieved if it exists for the code entered (See Figure 10-26).

Entries into this screen are presently case sensitive. Ensure that uppercase letters in error codes are entered as such into this screen.

NOTE

The user may enter a valid 16-digit hex code but receive unknown help text. This is because the help file has not been updated for the particular code. The functionality of this view is dependent on the validity and thoroughness of the help file.

Figure 10-26. Typical Error Code Help Results

Click OK to retrieve detailed information on this error as shown in Figure 10-26. This information is derived from the Network Diagnostic Tool error code database.

If the PC is not connected to the OC unit the error dialog box shown in Figure 10-27 may be displayed when the Get Help button of Figure 10-25 is clicked.

At this point the PC Link must be re-established. This can be done by re-launching the Network Diagnostic Tool.

Network Diagnostic Tool Version 1.10 (N800306-0001)
Results:
16 digits entered:1000100010001000
The Event: Unknown TRACK error - Code: 1000 1000 1000 1000
Help ID: 1036
OK
Java Applet Window

Figure 10-27. Unknown Error Code

10.7. Close Window/Exit Application

To exit the OC Network Diagnostic Tool, click on the X at the top right of the window.

11. APPLICATION PROGRAMMING

Application programming is the ASTS USA or customer designed site-specific OC software code. It defines specific location control data to the OC. The OC system logically processes this application I/O data to control the interlocking.

This section will provide an overview of basic OC application programming mechanics, techniques, concepts, and rules.

NOTE

OC application program written using MICROLOK II rules.
Program is compiled with OC compiler
Compiler creates: *.mlp, *.mll, and *.ml2 files.

11.1. Developing a MICROLOK Object Controller Application

The general process for developing and implementing an OC application is shown in Figure 11-1.

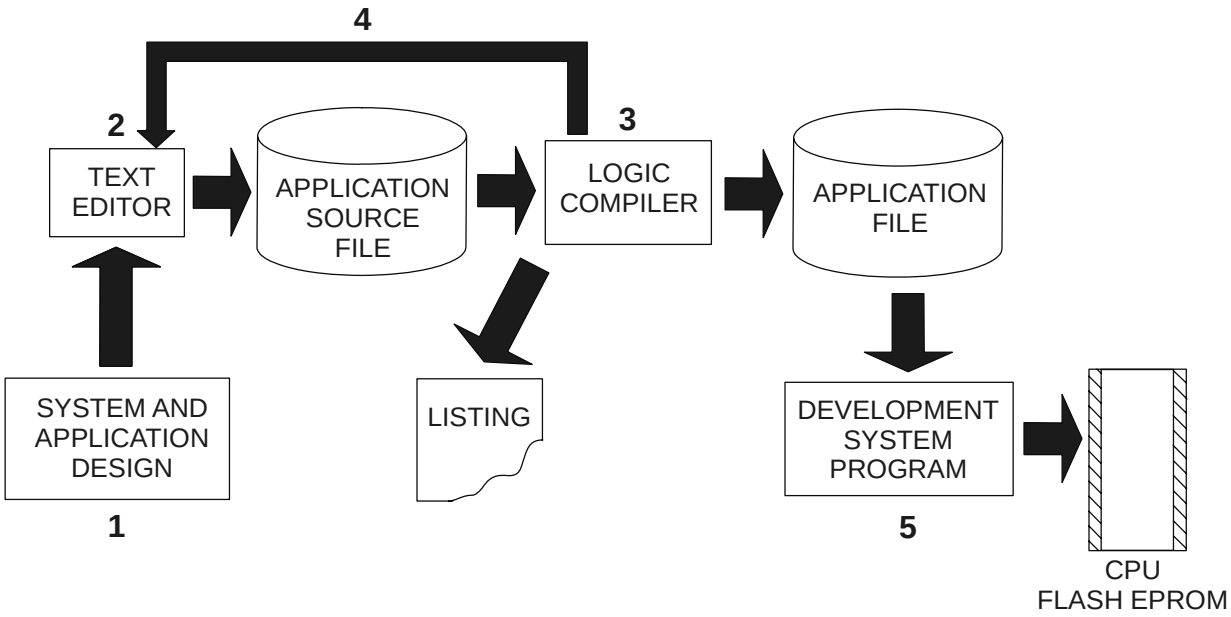


Figure 11-1. Development System Block Diagram

An application engineer reviews the planned OC application and identifies specific system requirements such as the OC circuit boards to be used, system interconnects, vital and non-vital I/O requirements, and all required interlocking logic.

The OC system programmer creates a unique application source file based on the system requirements specified by the application engineer. The programmer uses a standard text editor to create the source file. The source file must be saved as a text file to be usable by the compiler. However, the text file can be saved with an *.ML2* extension to identify it as an OC application. The compiler searches, by default, for a **.ML2* file in browse (Development System dialog box).

NOTE

The compiler is a DOS based program and as such has a character limit for a file path. Do not save application files in lower sub-directories when accessing them via the OC Diagnostic Tools. Save the file to a main folder.

The completed application source file is then processed by the OC logic compiler. The compiler reads the source file and verifies that the content of the file follows the prescribed format and conventions. The compiler produces an application file (*.MLP* file extension) and a listing file (*.MLL* extension) that contains a summary of the application program, as well as any errors detected in the source file.

Based on the severity and types of errors detected by the compiler, the application source file may need to be corrected using the text editor and run through the compiler again. The previous steps are repeated until the compiler produces an acceptable application file.

The compiled application file is transferred to a laptop computer and then uploaded to the appropriate OC installation during system startup. The OC Diagnostic Tools program is used to do this.

11.2. Programming Mechanics

OC programs are free format and are not case sensitive. Comments, which is text ignored by the compiler, begin with a '%' and end with a '\'. Single line comments may be identified with '//'. Additionally, comments may be delimited with /* and */.

The term <bit> is used to represent a single application logic Boolean bit. The user specified name consists of numbers and letters. While a name may begin with a number, it must contain at least one letter.

For example: flash, 1TK, NWZ.

The term <bit list> is used to represent a list of Boolean bits. Each bit name is separated by a comma. The bit list may contain from one to the maximum allowable number of bits (4000 per program).

A term enclosed in brackets < > is meant to represent a special type of user defined bit.

For example, in the segment `OBJECT_CONTROLLER PROGRAM <program name>;`, the term `<program name>` follows the same rules as a <bit>, but the item also has a special meaning, that being the program name.

`<name>` is a user supplied program value. The valid values are explained near the definition.

ID names can contain letters or numerals. They may start with a numeral but must contain at least one letter.

`<bit list>` is a comma-separated list of valid id names that refer to Boolean bits.

`<variable list>` is a comma separated list of valid id names that refer to numeric variables.

Brackets `[ ]` are used to enclose optional parts of program statements. The brackets themselves are not part of the program.

Structures such as `[bill] | [george]` indicate that either `bill` or `george` can be placed in this location in the program statement.

11.3. Main Program Body

The actual system logic is written in the main program body. Every internal or output relay bit name defined in the INTERFACE and VAR sections should be given a value in the main program body (except Spare [keyword] bits). This is done by making the bit the object of an ASSIGN statement. If an output bit is not the object of an ASSIGN statement, the program may operate properly, but that bit will be ignored. Serial input bits (from Master or Slave) may be the object of an ASSIGN statement.

11.4. Breaks Before Makes Rule

The Executive Software recognizes that the order in which equations are executed affects the internal and output states of the system. To emulate relay circuits operation as closely as possible, the Executive Software employs the traditional "break before make" rule of relay systems. It determines which equations involve the "front contact" and which equations involve the "back contacts" of a relay in a typical application. Depending on whether the relay picks or drops, one set of contacts is defined as the "breaks" and one set is defined as the "makes." Those equations that are the "breaks" are executed before those that are the "makes." When a change of state is observed by an input, internal or output bit, all logic equations that involve a contact of that bit are queued for execution, breaks before makes.

The OC executive places all equations to be executed in a queue, breaks before makes.

11.5. Logic Processing

An ASSIGN statement is equivalent to tracing the path or paths of current flow from a battery to the assigned relay coils. Therefore, the logic for all of the wiring associated with that relay coil must be contained in one ASSIGN statement. The order of the ASSIGN statements in the source program will usually have no effect on the output.

An ASSIGN statement is re-computed each time one of the relay coils included in the statement changes state. This involves the following chain of events.

The system first determines if the coil has a timing delay. If so, the specified time is run until the relay is set or cleared. Assignments for non-timer coils are carried out immediately, and all ASSIGN statements in which this coil is referenced are re-computed. This process continues until the system reaches a stable state. During the time ASSIGN statements are being computed, no output updates (local or remote) are performed; inputs are still scanned at 50 millisecond rate. Any output started before the logic sequence will continue to be processed. However, outputs cannot be updated.

To follow most relay-logic design practices, logic processing always uses a break-before-make format. When a relay changes values, the break is done before the make.

Equations are processed relay by relay, with breaks executed before makes for any given relay in the order which they occur. In Figure 11-2, if relay R1 changes state, EQ1 is executed (break), followed by EQ2 (make). Next, the change in EQ1 (relay R2) causes EQ3 to be executed (break), thus the make of EQ2 occurs before the break of EQ3.

A maximum of 4000 equations may be queued at any one time.

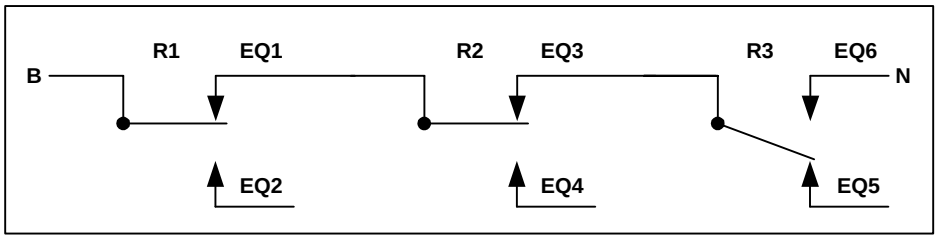


Figure 11-2. Queuing Options Reference Diagram

11.6. Comparison of Hardware and Software Relay Logic

There are limits to which the OC system can emulate actions and reactions of a relay system. Relay systems, which are based on electrical hardware connections, processes multiple logic functions in parallel. The OC, which is based on a microprocessor and software, processes multiple logic functions sequentially. For example, where a single contact in a relay system is used in processing two different logic functions, both logic functions start processing simultaneously when the relay changes state.

In Figure 11-3, the RA equation is the front contact and the RB equation is the back contact. All equations that use the NOT operand are a back contact. In a relay system, there will be a measurable time when R1 starts to drop, when neither the front nor back contacts has energy applied. In the OC, this transfer is instantaneous. Either the front or back contact has energy applied at all times.

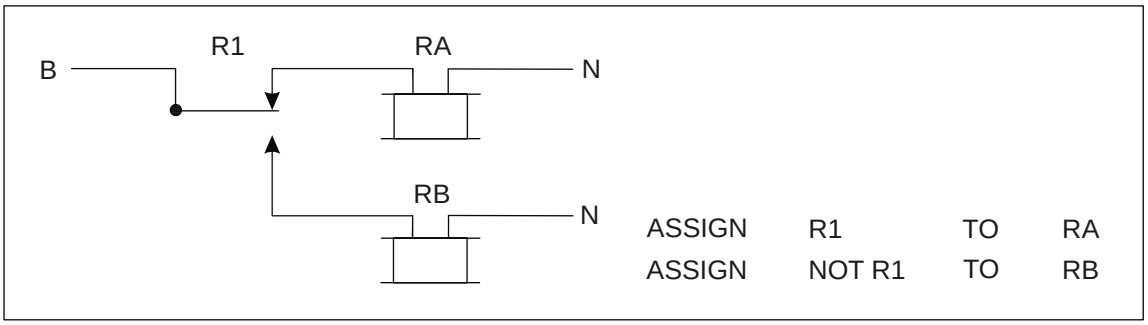


Figure 11-3. Example of Front and Back Contact Assignments

11.7. Queuing Options

The Executive Software takes equations out of the queue one at a time, starting with the first equation and continuing until the queue is empty (Figure 11-4). If any executed equation causes a change in the value of any bit, more equations may need to be executed. If so, the new equations are placed, breaks

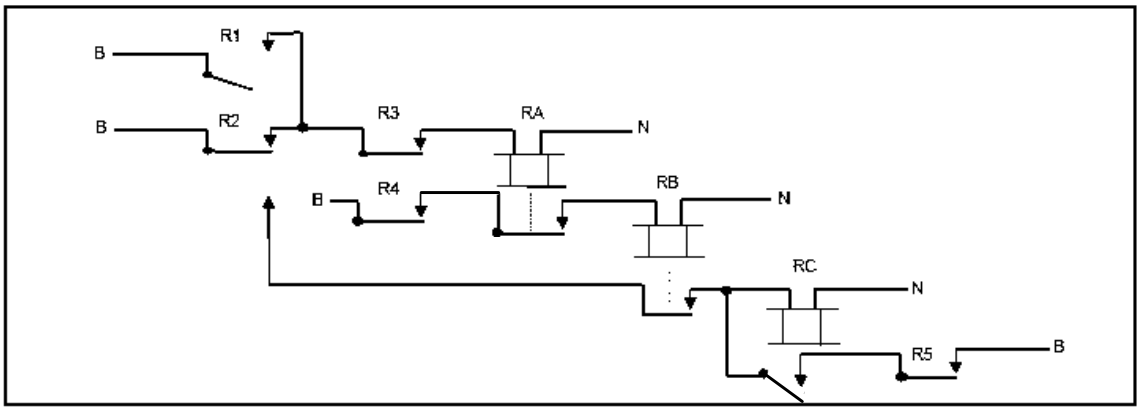


Figure 11-4. Queuing Option Example

before makes, at the end of the queue after any equations that are already queued. The Executive Software continues to execute equations, one at a time, until the queue is empty.

At this time, any changed outputs will be delivered to the output processors.

When R2 drops, both the RA and RC equations are placed on the queue to be executed. RA, which involves the break, is queued and executed first. When the RA equation is executed, RA drops. This causes the RB equation to be queued. Since there is only one queue, the RB equation is placed in the queue after the RC equation. The RC equation is then removed and executed. RB is still picked and R2 is dropped, causing RC to pick. Since RC has now changed state and is used in the RC equation, this equation goes back on the queue after the RB equation. The RB equation is removed from the queue and executed. This causes RB to drop.

The RC equation is removed and re-executed. RB is now down. However, since RC has already picked and has a valid path through a stick circuit, RC remains picked.

This flasher relay set-up could not exist in actual relay logic, but is possible with the OC by establishing a distinct pick-up/drop-away interval for the relay. The pertinent parts of the program include:

T1: SET=1 :SEC CLEAR=1 :SEC;

ASSIGN NOT T1 TO T1; (Figure 11-5)

If the timer value is not specified, the "contact" will operate at a speed which cannot be detected by the run time system. This would create an indeterminate function at this point, inhibiting execution of the program.

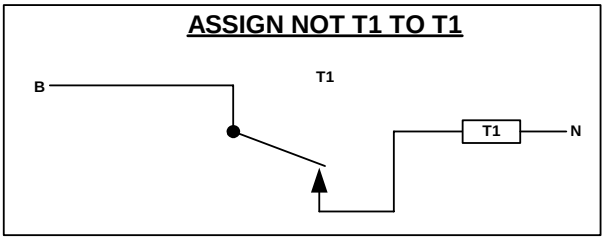


Figure 11-5. Conceptual Relay Model for Object Controller Programming (A)

The double coil relay examples in Figure 11-6 are conceptual models that pertain to signal control slotting.

Models cannot apply to circuits with control contacts to both coils of a double-coil relay. The pertinent program statement for the model containing the CANCEL contact is:

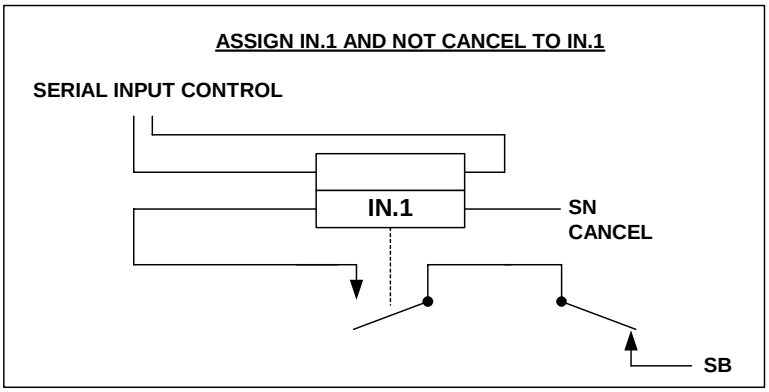


Figure 11-6. Conceptual Relay Model for Object Controller Programming (B)

ASSIGN IN.1 AND NOT CANCEL TO IN.1;

The capability to assign to serial inputs may be applied to the design of auto clearing controls. In the case of auto clearing of requests, if the input is a request for a clear signal and CANCEL is a track relay, the signal request will be cleared when the track is occupied.

Cascading timer relays (Figure 11-7) are used to build up a comparatively long delay on the output delay relay. Only one timing specification (SET and CLEAR) needs to be written for all timer relays (equal addends for the desired delay):

Tl, T2: SET=5:SEC CLEAR=5:SEC

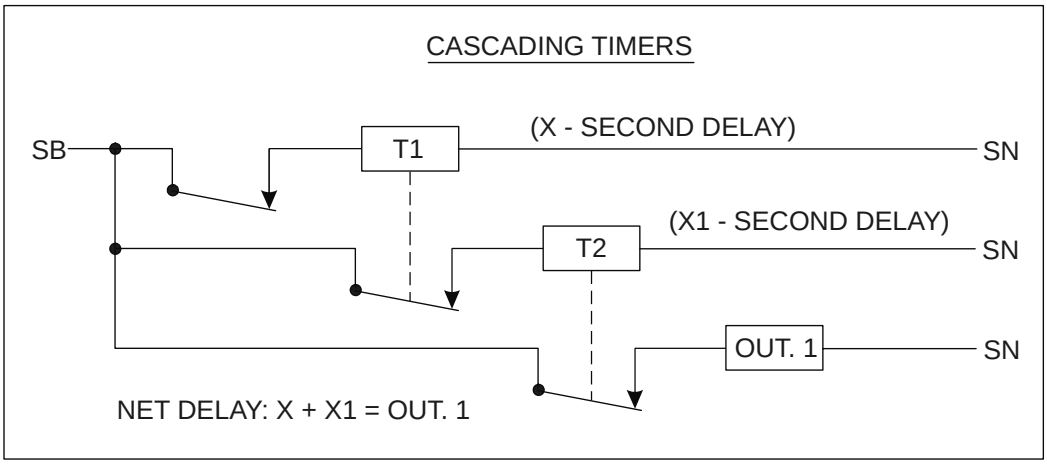


Figure 11-7. Conceptual Relay Model for Object Controller Programming (C)

11.8. ASSIGN Statement

The ASSIGN statement enables the various Boolean operators (OR, NOT, etc.) and bit names to be combined in logic equations.

Four logical operators are available to create expressions in a program (Table 11-1).

Table 11-1. Logical Operator Symbols

RESERVED WORD	SHORTHAND OPERATOR
NOT	~
AND	*
OR	+
XOR	@

Either form (reserved word or shorthand operator character) may be used in assignment expressions.

For example:

```
ASSIGN IN.A XOR IN.C AND (NOT IN.A OR IN.B) TO OUT.5;
```

Either form (reserved word or shorthand operator character) may be used in assignment expressions.

For example, the above ASSIGN statement may be written using shorthand symbols:

```
ASSIGN IN.A @ IN.C * (~IN.A + IN.B) TO OUT.5;
```

The operators AND, OR, NOT, and XOR, along with their shorthand symbols, are evaluated according to the truth table shown in Figure 11-8.

INPUTS		AND	OR	XOR	NOT	
A	B	A * B	A + B	A @ C	⌣A	⌣B
0	0	0	0	0	1	1
0	1	0	1	1	1	0
1	0	0	1	1	0	1
1	1	1	1	0	0	0

Figure 11-8. ASSIGN Operators Truth Table

The order of evaluation is determined by the following precedence rules:

HIGHEST: NOT, AND
LOWEST: OR, XOR

Operations with the highest precedence are performed first (Figure 11-9). Operations at the same precedence level are evaluated left to right. Parentheses may be added to alter this default order. Parentheses take precedence over the defined operational order.

If more than one relay is to be assigned the same value, the logic expression need not be repeated in a second ASSIGN statement. Additional relay names may be assigned using the same statement by listing them after the Reserved Word "TO," separated by commas.

For example:

ASSIGN A AND B OR NOT C TO D,E,F;

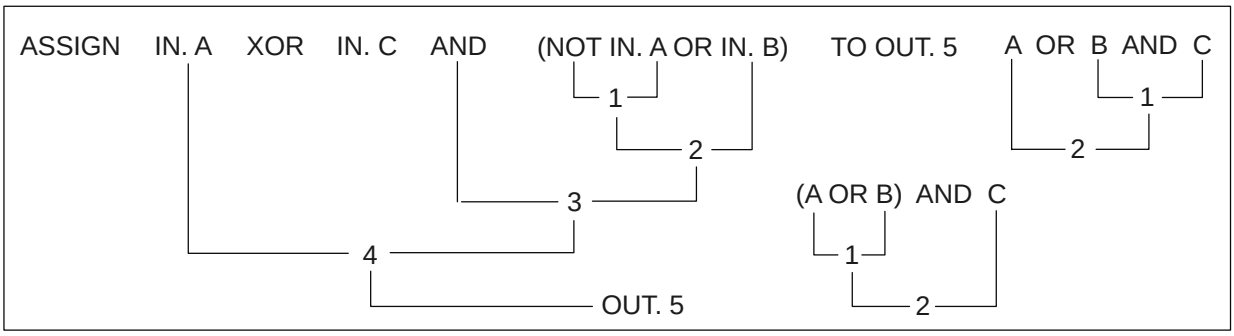


Figure 11-9. ASSIGN Operators and Order of Precedence Samples

11.9. Compiler Defined System Bits and Numerics

Several bits are predefined by the compiler to indicate executive status information to the application and to allow the application to control some executive functions. These bits are shown in Table 11-2.

Similarly, there are several numerics predefined by the compiler to allow access to the time of day. These bits are listed in Table 11-3.

Table 11-2. Compilier Defined System Bits

SYSTEM BIT NAME	APPLICATION ACCESS TO BIT	BIT FUNCTION
RESET	Read/Write	Resets system
QUICK.RESET	Read/Write	QUICK.RESET can be the object of an application logic equation. If this bit ever becomes true the system resets, ignoring any reset delay defined in configuration.
KILL	Read/Write	Kills Critical Power Supply (CPS)
CPS.ENABLE	Read/Write	Enables CPS if set during initial logic processing.
CPS.STATUS	Read	Indicates CPS is up
CONFIGURE.ERROR	Read	EEPROM Configuration was Invalid. This bit will be set any time you upload software because the old and new CRCs will be different. After uploading software you must go through a system configuration even if you do not change anything. As you do so, the new CRC will be loaded into the EEPROM and the CONFIGURE.ERROR bit will clear.
LOG.LARGE	Read	User bit log is ≥ 75% full
LOG.FULL	Read	User bit log is full and being overwritten.
CLOCK.FREEZE	Read/Write	Set to make the clock numerics update to current value and stop changing
CLOCK.SET	Read/Write	Setting this bit will cause the time of day clock to be updated from the values in the clock numerics.
LED.n	Read/Write	Non-Vital outputs displayed on Front Panel CPU LEDs. The value of n is between 1 and 4.
LOG.OK	Read	Data in user log is valid when bit is set.

Table 11-3. Compilier Defined Time of Day Bits

SYSTEM NUMERIC NAME	APPLICATION ACCESS	NUMERIC FUNCTION
CLOCK.MONTH	Read/Write	Month of year 1-12
CLOCK.DAY	Read/Write	Day of month 1-31
CLOCK.YEAR	Read/Write	Year 0-99
CLOCK.HOUR	Read/Write	Hour of day 0-23
CLOCK.MINUTE	Read/Write	Minute of hour 0-59
CLOCK.SECOND	Read/Write	Second of minute 0-59

The hardware making up the system clock is non-vital; therefore, all of the system bits associated with the system clock are non-vital and should not be used in vital equations.

11.10. Reserved Words

Reserved words are alphanumeric phrases that have a special meaning to the OC compiler.

The words shown in Table 11-4 cannot be used as program variables.

Table 11-4. Reserved Words

RESERVED WORDS FOR THE OC COMPILER		
ADDRESS	ADJ	ADJUSTABLE
AFTER	AND	ARRAYS
ASSIGN	ATTRIBUTES	BAUD
BEGIN	BIT	BITS
BLOCK	BOARD	BOOLEAN
CAB FREQUENCY	CAB RATE	CARRIER MODE
CLEAR	CODE SUBSET	CODED
CODER OUT	COMM	CONFIGURATION
CONSTANT	CONSTANTS	CRC SIZE
DEBUG PORT ADDRESS	DEBUG PORT BAUDRATE	DELAY RESET
E TRACK	ELSE	ENABLE
END	ERROR	EVALUATE
EVEN	EXECUTIVE FUNCTION	FAST CODES
FIX	FIXED	FOR
FROM	GENISYS	GENISYS MASTER
GENISYS SLAVE	IF	IN16
IN8 OUT8	INITIALIZE TIMER	INITIALIZED
INPUT	INPUTS	INTERBYTE TIMEOUT
INTERFACE	INTERPOLATE	KEY OFF DELAY
KEY ON DELAY	KEYED	LAMP OUT
LAMP16	LENGTH	LINK
LOCAL	LOG	LOGIC
LOGIC TIMEOUT	MAP	MARK
MASTER	MASTER CHECKBACK	MASTER TIMEOUT
MICROLOK	MICROLOK MASTER	MICROLOK SLAVE
MICROTRAX	MIN	MOD
MODE	MSEC	NAME
NONE	NOT	NUMERIC
NUMERIC INPUT	NUMERIC OUTPUT	NUMERICS
NV ASSIGN	NV BOOLEAN	NV EVALUATE
NV IN32 OUT32	NV INPUT	NV NUMERIC
NV NUMERIC INPUT	NV NUMERIC OUTPUT	NV OUTPUT
NVB OUT12	ODD	OFF
ON	OR	OUT16
OUTPUT	OUTPUTS	OVERRANGE
PARITY	POINT POINT	POLLING INTERVAL
PORT	PRAGMA	PROGRAM
PROTOCOL	QUESTION	RANGES
RESTART TIMER	ROUND	SEC
SECTION	SECURE MODE	SET
SHARED RAM	SHUTDOWN	SLAVE
SLOT	SPACE	STALE
STALE DATA TIMEOUT	STANDARD	STATE
STOPBITS	SYSTEM	TABLE
TABLES	THEN	TIME SINCE START
TIMER	TO	TOGGLE
TRACK	TRACK NAME	TRACKA
TRACKB	TRIGGERS	TRUNCATE
TRX TRACK	TYPE	UNDEFINED
UNDERRANGE	USER	VARIABLES
WATT	WHEN	WITH
XOR	YIELDS	

11.11. Boolean Expressions

Equation Format:

ASSIGN 1ATP AND 1BTP TO 1TP;

Where: 1ATP and 1BTP are operands,

AND is an operator,

together they are a 'Boolean expression' and

1TP is the object or result

Operators:

NOT ~, ! Opposite

AND &, * Series

OR |, + Parallel

XOR @, ^ Cross-check

Order of Precedence:

Parenthesis, NOT, AND, OR/XOR

11.11.1. Boolean Logic - ASSIGN Statements

The OC Boolean Logic Section of the program does not execute in the same manner as a typical computer program. An OC program only executes those `ASSIGN` or `NV.ASSIGN` statements that need to be re-evaluated based on changes. The OC maintains a special data structure called a Logic Evaluation List, which holds a list of assignment statements that must be re-evaluated based on changes. For example, whenever an input in the system changes, the executive software will mark all equations that use that input bit. These equations are marked by 'placing' them on the trigger list. When the equations are executed they are removed from the trigger list. By supporting this data structure, only those portions of the program that must be re-evaluated will be processed.

The Logic Evaluation List is actually divided into two separate lists. Since relay logic follows a 'break before make' rule, the Logic Evaluation Lists are divided into BREAK and MAKE lists.

`NV.ASSIGN` statements are executed in the same manner as the vital `ASSIGN` statement and at the same priority.

A vital assign statement has more checks than a non-vital assign. On complex equations, NV.ASSIGN statements will run faster. In normal operation the timing difference is negligible.

A maximum of 499 statements can be awaiting execution at any time on each of the execution queues for `ASSIGN` and `NV.ASSIGN` statements.

If an OC program only contains a `BOOLEAN` Section with `ASSIGN` statements, the program will execute in the same manner as MICROLOK II.

11.12. Boolean Logic vs. Relay Logic

The examples shown in Figure 11-10, Figure 11-11, and Figure 11-12 compare Boolean logic code to relay equivalent circuits.

11.12.1. ASSIGN Statement One

(Refer to Figure 11-10)

ASSIGN R62AS * (59TPS + 59SS) TO 59SS;

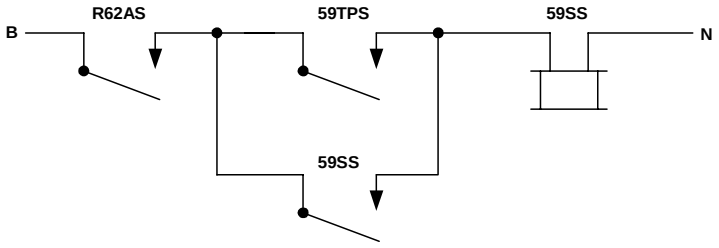


Figure 11-10. ASSIGN Statement One

11.12.2. ASSIGN Statement Two

(Refer to Figure 11-11)

ASSIGN ~59EMTEZ * (L60HS * 59NWC + L60AHS * 59RWC + ~59TPS * R62VS)

TO R62VS;

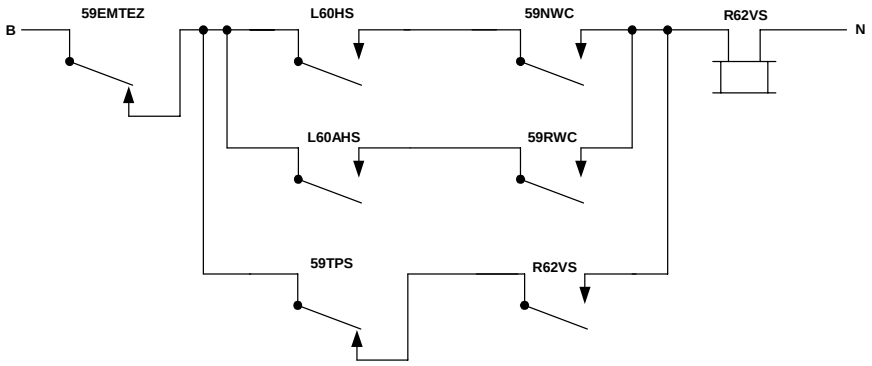


Figure 11-11. ASSIGN Statement Two

11.12.3. ASSIGN Statement Three

(Refer to Figure 11-12)

ASSIGN ~R62RCS * R62RGP * (60TPS + ACPOS * ~59TPS*(~A51TPS +59NWC) * (~51TPS + 59RWC) + R62TE + R62AS) TO R62AS,NV_R62AS;

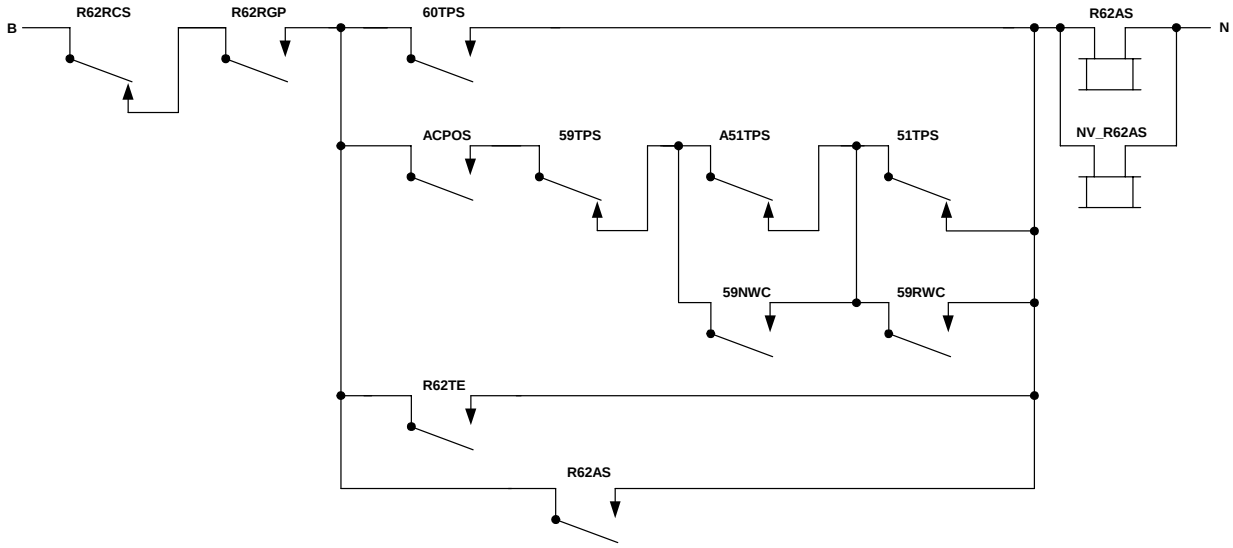


Figure 11-12. ASSIGN Statement Three

11.13. Programming Limitations and Rules

CAUTION

OC applications must consider all the guidelines of SM 6800G.

Boolean expressions are used in `ASSIGN`, `NV.ASSIGN`, and `IF` statements. These statements may consist of any of the operators and any numeric or Boolean variables, constants, or numeric arrays. The compiler generates these expressions in the application image assuming two stacks and evaluation using reverse polish notation. One of the stacks is used for numeric operands and intermediate numeric results. The other stack is used for Boolean variables and intermediate results. If an expression results in a sequence of operations generated by the compiler that requires either the numeric or the Boolean stack to hold more than 20 elements, the compiler will produce an error. Also, an expression may not contain more than 60 operators of any kind or more than 20 numeric operators including array accesses.

11.13.1. Program limitations

Rules and limitations that can cause problems if not considered, that is, a program that won't compile or a program that crashes the OC in operation.

- 4000 bit names in a program.
- 128 IN and OUT designations in a special list (Vital).
- 512 IN and OUT designations in a special list (Non-Vital).
- 32 Addresses per port declaration.
- 4095 ASSIGN statements.
- 499 equations on the queue list at a time.
- 50 triggers maximum per bit.

11.13.2. Serial Port Limitations

The SCC Board provides 2 Ethernet or 1 Ethernet and 1 RS-232 ports.

The Ethernet port(s) support the PEER protocol.

The RS-232 port supports the MICROLOK. GENISYS, and PEER protocols.

11.14. Network Diagnostic Tool

The Network Diagnostic Tool is a web-based ASTS USA designed software package that is used to interface with the system for monitoring and management. It is used to upload an application program to the OC system and configure the OC during system commissioning.

Other tools included in the Network Diagnostic Tool allow for monitoring and adjustment of system configuration items, and viewing of event and error logs.

The Network Diagnostic Tool also obtains system status and historical information from the system log, user log, and error log, and debug the application logic by displaying logic states as the program executes. The Network Diagnostic Tool is a web-based tool that must be used with a Java enabled version of Internet Explorer which is run on a laptop or desktop PC. The PC is connected to the Ethernet WEB TOOL port. The OC is accessed by its unique IP address.

12. COMPILING AN OC APPLICATION

This section details the use of the ASTS USA Off-Line Tools of the Serial Diagnostic Tool, part number N8003020001, and their interface with the OC. It provides information on maintenance and troubleshooting techniques necessary for personnel to maintain the OC in a manner that ensures operational integrity with a minimum of downtime.

12.1. Compiler

The Serial Diagnostic Tool for Executive Versions 1.2 and earlier must be installed on your PC to compile an OC application by using the "Run The Compiler" button (See Figure 12-1).

Beginning with Executive Version 1.3 a new stand-alone compiler is available to compile a 1.3 application.

NOTE

While the 1.1 version compiler is usable over all software releases with a main revision of "1.x" it is still advisable to use the same version compiler as the executive installed on the OC.

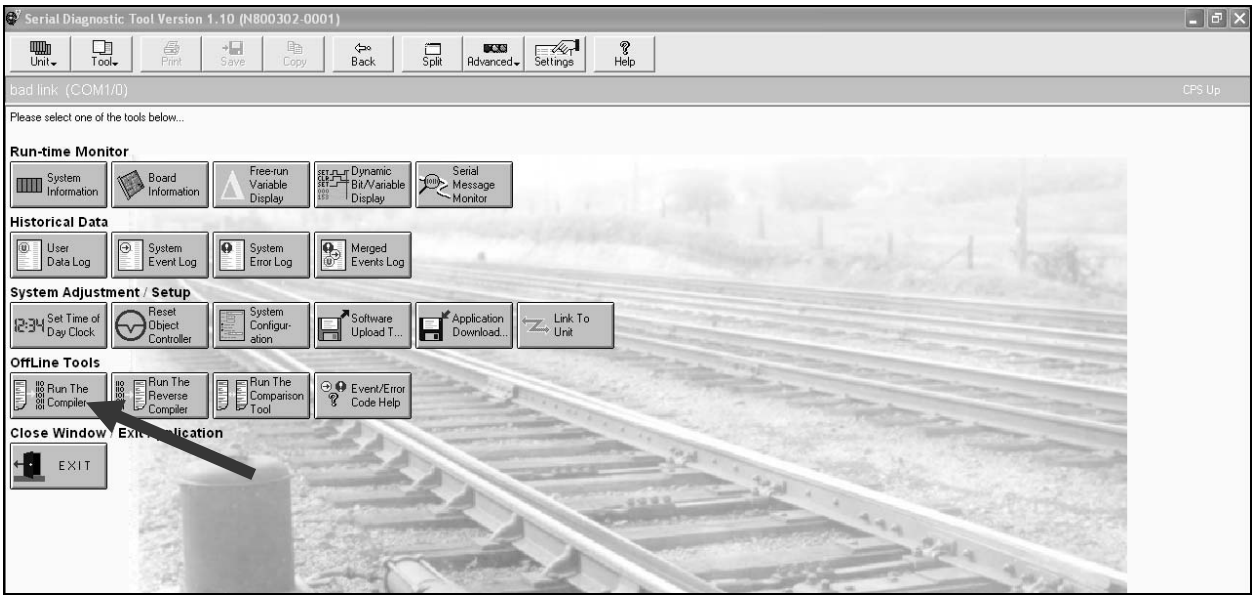


Figure 12-1. OC Serial Diagnostic Tool Main Menu

12.1.1. Running the Compiler

Refer to Section 4.3, "Running the Compiler," in SM-6800D.

The compiler converts an OC text (*.ML2) file into an application (*.MLP) file.

The OC stand-alone compiler (mlk2comp.exe) should be copied to a user-created top-level directory of the PC drive, for example: C:\MLK_Comp.

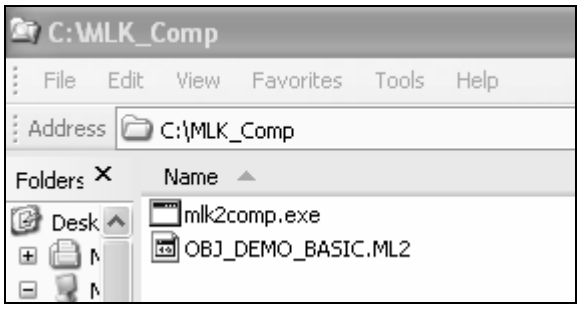


Figure 12-2. Example File Structure

The application to be compiled (for example: OBJ_DEMO_BASIC.ML2) should also be placed into this directory.

NOTE

When running the compiler from a DOS command line prompt, ensure that the application source file name (*.ML2) follows the DOS restrictions for file naming.

Open the Command Prompt DOS window (typically found under the Windows programs "Accessories" folder) and navigate to the compiler directory. Refer to Figure 12-3.

The compiler is invoked by entering the following command line prompt in the DOS window: (See arrow in Figure 12-3).

MLK2COMP sourcefile[.ext]

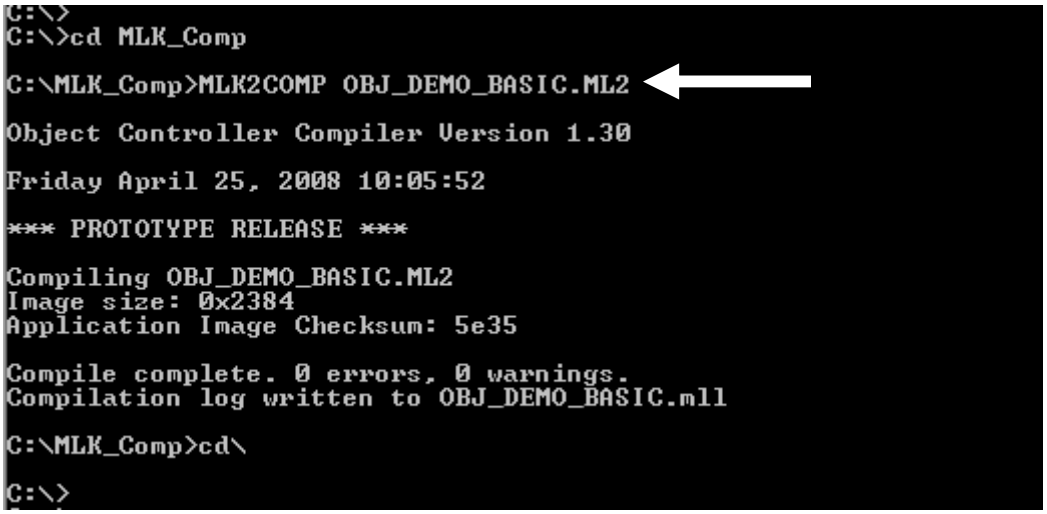


Figure 12-3. DOS Command Line Navigation

The compiler returns a non-zero value to the command processor if there were any errors during compilation, or if there was any problem with the form or content of the command line.

Otherwise, the compiler returns zero (See Figure 12-3). The compiler automatically creates the compiled files (*.mlp and *.mll) in the same file directory.

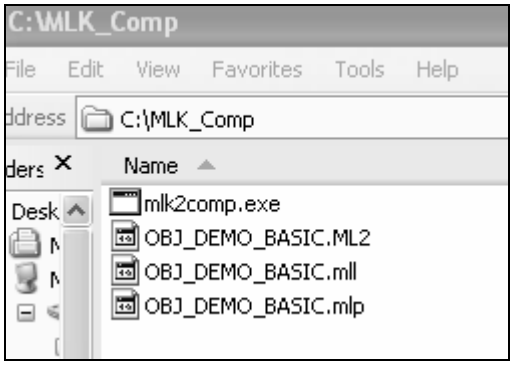


Figure 12-4. Compiler with Compiled Files

The compiled files, as in the example, are shown in Figure 12-4.

12.1.2. Output Image File

Refer to Section 4.4, "Output Image File," in SM-6800D.

The output image file (*.mlp):

- The primary output of the compiler is a memory image.
- The initial Programmable Read Only Memory (PROM) Table begins at the lowest address in the file. Unless overridden on the command line, the address is dependent on the kind of application specified in the "PROGRAM" statement. For the OC, the PROGRAM TYPE is Object Controller.

The default base address and maximum size for an application is listed in

- Table 12-1.

Table 12-1. Application File Default Address and Size

APPLICATION TYPE	BASE ADDRESS	MAXIMUM SIZE
Object Controller	0x000B0000	050000

12.1.3. Listing File Information

Refer to Section 4.5, "Listing Information," in SM-6800D.

Note these general points concerning the listing file (*.mll):

- The listing file provides information about compiler-generated information in the application, as well as reports about usage of various resources defined in the application.
- The listing shows the date of compilation, and the version number and date of the compiler.
- Can be used for bit identification when using the Serial Diagnostic Tool.

12.1.4. Source Listing

Refer to Section 4.5.1, "Source Listing," in SM-6800D.

Note these general points:

- The source listing shows warnings, severe warnings, and errors; plus, it shows relevant statement numbers assigned by the compiler.
- The warnings and errors are interspersed between the source listing lines (if they exist).

Each line of the source listing has this form:

<line number> <text of original source line> [<statement number>]

If a line does not have an associated statement number, the <statement number> portion will appear blank. Lines with statement numbers are those with:

- ASSIGN
- NV.ASSIGN
- EVALUATE
- NV.EVALUATE
- IF statements
- TIMERS

The compiler generates statement numbers to aid in debugging. Errors and warnings reported by the executive refer to statements by statement number.

12.1.5. Application Image Identification

Refer to Section 4.5.2, "Application Image Identification," in SM-6800D.

After the source listing, the compiler presents enough information to correctly match the listing to the application.

This information consists of:

- Target type – Object Controller
- Cyclic Redundancy Check (CRC) of application image as used by the Serial Diagnostic Tool.

Checksum that would be seen on Flash Erasable Programmable Read Only Memory (EPROM) programmer.

12.1.6. I/O Board Address Jumper Settings

NOTE

Jumper settings are preconfigured at the factory.

Refer to Section 4.5.2.1, "I/O Board Address Jumper Settings," in SM-6800D.

Note that the wiring and I/O board address jumper settings are dependent on the organization of the OC program's I/O Section, and that the settings are listed separately from the rest of the I/O board information.

For each defined board, the compiler lists:

- Board name as defined in the application
- Board type
- A text picture of switch positions drawn with 1's and 0's characters where 1 represents the jumper shunt, and 0 represents an open jumper is shown below:

  *** Address Select Jumper Settings:

  THESCC: SCC
  0 1 2 3 4 5 6 7
  1 0 0 0 0 0 0 0

12.1.7. Unassigned/Unused Variable Summary

Refer to Section 4.5.4, "Unused Variable Summary," in SM-6800D.

To call attention to variables that the system or the user defined but never used in logic, the compiler generates a list of such bits. Note, however, that I/O points defined as SPARE do not appear in the list. The list looks like the example that follows:

<id number> <id name> <bit type>

12.1.8. Bit Usage Summary

Refer to Section 4.5.7, "Bit Usage Summary," in SM-6800D.

Information about each bit used in the system is displayed in a table. Part of an example table follows.

ID#	ID Name	FRONT	BACK	BLOCK	TABLE	CODE	ASGN	TARG	VITAL	
14	34R	0	0	0	0	0		ASGN	VITAL	OUT
123	1ASR	1	3	0	0	0		ASGN	VITAL	INT
125	TRIG	0	0	1	1	0		ASGN	VITAL	INT
126	ERROR	0	0	0	0	0	23	NASGN	NON	Int

12.1.9. Numeric Usage Summary

Refer to Section 4.5.8, "Numeric Usage Summary," in SM-6800D.

Information about each numeric used in the system is displayed in a table. Part of an example table follows:

ID#	ID Name	EVAL	TARG	VITAL	
300	SPEED	1	EVAL	VITAL	OUT LINK:SHARED, OUT:10
364	ELAPSED	3	NEVAL	NON	INT
365	TRIG	5	IN	VITAL	IN LINK:SHARED, IN:25

12.1.10. I/O Board Summary

Refer to Section 4.5.9, "I/O Board Summary," in SM-6800D.

Note this information:

- I/O boards are summarized by board name and type, as well as the state any configuration parameters belonging to it.
- Entries for all boards show the state of the enable as defined in the application, as well as its fixed or adjustable status.

12.1.11. COMM Link Summary

Refer to Section 4.5.10, "COMM Link Summary," in SM-6800D.

Note this information:

- COMM Links are summarized by link name and protocol, as well as the state of any configuration parameters belonging to it.
- Entries for all links show the state of the enable as defined in the application, as well as its fixed or adjustable status. Also, the enabled state of each of the stations on the link is displayed.

12.1.12. System Level Configurable Parameters

Refer to Section 4.5.11, "System Level Configurable Parameters," in SM-6800D.

Note that the compiler lists the state of all of the system level configuration parameters, and if they are adjustable.

12.1.13. Compiler Checks

Refer to Section 4.6, "Compiler Checks," in SM-6800D.

Note that, in the course of processing the source file, the compiler can generate errors, warnings, and severe warnings.

Errors are generated in response to source code that cannot be interpreted by the compiler as a meaningful program.

Warnings are generated for inputs that may cause safe, but unusable behavior.

Severe warnings are generated when the user input can be interpreted as a usable program, but the compiler makes corrections to the source code. Severe warnings are intended to notify the programmer of what corrections the compiler has made.

NOTE

The compiler checks the application for program integrity only; it does not check logic.

12.1.14. Debugging – Typical Compiler Errors

When a program is compiled and an error is generated, the .mll file is usually available for debugging purposes.

Search for the word "Error" to locate the approximate line in the program where the error occurs.

The error must be corrected in the original .ml2 file and saved before the next recompile.

Common errors are explained in the following sub-sections.

12.1.14.1. Range Error

1134
BOOLEAN BITS

ERROR: Links must have a unique port number.
This indicates that a port was not assigned a correct value.

12.1.14.2. Syntax Error First Example

458 /* BYTE 1 */
459 Z1_L14HGP,

ERROR: Syntax error on line 459, at or before "Z1_L14HGP":
The compiler found no semicolon to end the group.

12.1.14.3. Syntax Error Second Example

```
2727    (~R48HS * 14SS * 47NWC  1NTBR + SZ21_R44HZSB * SZ21_16SS *

ERROR:    Syntax error on line 2727, at or before "1NTBR":
(~R48HS * 14SS * 47NWC  1NTBR
```

The required operand is missing. "*"

12.1.14.4. Undefined Error

```
4633    assign b1     to B2;

ERROR:   b1 is not defined.
   -432-
ERROR:   B2 is not defined.
4634
```

ERROR: b1 is not defined in any <bit list>.

12.1.14.5. Usage Error

Warning and unused bits: Inefficient - but no errors.

```
4473    ASSIGN
4474    R58OSNP
4475    TO R58OSNK;
   -407-
WARNING: Vital assign to non-vital variable, R58OSNK (inefficient).
4476
```

This means the program compiled with all necessary files. This program will operate but the compiler is warning of inefficient operations. A non-vital statement is given a vital assign beginning.

13. SAMPLE APPLICATIONS

13.1. IN6.OUT6 and MIX I/O PCBs with PEER Serial Link Application

```
OBJECT_CONTROLLER PROGRAM SAMPLE.OBJECT_CONTROLLER.APP;

SITE.ID.STRING: "PITTSBURGH LAB";
DATE.STAMP: "JUNE 7, 2006";

INTERFACE

  LOCAL

    BOARD: THESCC
    ADJUSTABLE ENABLE: 1
    TYPE: SCC

    BOARD: THEIN6OUT6
    ADJUSTABLE ENABLE: 1
    TYPE: IN6.OUT6

       OUTPUT: OUT.1,OUT.2,OUT.3,OUT.4,OUT.5,OUT.6;

       INPUT:    IN.1,IN.2,IN.3,IN.4,IN.5,IN.6;
             ADJUSTABLE ENABLE: 1;

    BOARD: THEMIXIO
    ADJUSTABLE ENABLE: 1
    TYPE: MIXIO

       OUTPUT: BO.1,  BO.2,  BO.3,  BO.4;

       INPUT:    BI.1,  BI.2,  BI.3,  BI.4;
             ADJUSTABLE ENABLE: 1;

       NV.ANALOG.INPUT: AI.1;
             ADJUSTABLE ENABLE: 1;
             ADJUSTABLE MINIMUM.THRESHOLD: 12.2;  //0.0-30.0
             ADJUSTABLE MAXIMUM.THRESHOLD: 16.7;  //0.0-30.0

       PROXIMITY.SENSOR.1:
             ADJUSTABLE ENABLE: 1;

       PROXIMITY.SENSOR.2:
```

```
        ADJUSTABLE ENABLE: 1;

    COMM

        LINK: MII_PEER1

        ADJUSTABLE ENABLE: 1
        PROTOCOL: MII.PEER
        ADJUSTABLE PORT: 1;
        ADJUSTABLE BAUD: 38400;
        ADJUSTABLE STOPBITS: 1;
        ADJUSTABLE PARITY: NONE;
        ADJUSTABLE KEY.ON.DELAY: 0;
        ADJUSTABLE KEY.OFF.DELAY: 0;
        ADJUSTABLE GRANT.DELAY: 10:MSEC;
        ADJUSTABLE POINT.POINT: 1;
//      ADJUSTABLE MII.DEBUG.PORT.ADDRESS: 0;

        // VITAL STATION
        ADJUSTABLE MII.ADDRESS: 10

            ADJUSTABLE ENABLE: 1
            STATION.NAME: STATION_1;
            ADJUSTABLE PEER.ADDRESS: 20;
            ADJUSTABLE TIME.STAMP: 1;

            ADJUSTABLE ACK.TIMEOUT: 500:MSEC;
            ADJUSTABLE HEARTBEAT.INTERVAL: 1000:MSEC;
            ADJUSTABLE INDICATION.UPDATE.CYCLE: 5;
            ADJUSTABLE STALE.DATA.TIMEOUT: 3000:MSEC;
            ADJUSTABLE CLOCK.MASTER: 1;

            OUTPUT:
                MII.10.20.BO1,   MII.10.20.BO2,   MII.10.20.BO3,   MII.10.20.BO4;

            INPUT:
                MII.10.20.BI1,   MII.10.20.BI2,   MII.10.20.BI3,   MII.10.20.BI4;

        LINK: MII_PEER2

        ADJUSTABLE ENABLE: 1
        PROTOCOL: MII.PEER
        ADJUSTABLE PORT: 2;
        ADJUSTABLE BAUD: 38400;
        ADJUSTABLE STOPBITS: 1;
```

```
            ADJUSTABLE PARITY: NONE;
            ADJUSTABLE KEY.ON.DELAY: 0;
            ADJUSTABLE KEY.OFF.DELAY: 0;
            ADJUSTABLE GRANT.DELAY: 10:MSEC;
            ADJUSTABLE POINT.POINT: 1;
//          ADJUSTABLE MII.DEBUG.PORT.ADDRESS: 0;

            // VITAL STATION
            ADJUSTABLE MII.ADDRESS: 20

                ADJUSTABLE ENABLE: 1
                STATION.NAME: STATION_2;
                ADJUSTABLE PEER.ADDRESS: 10;
                ADJUSTABLE TIME.STAMP: 1;

                ADJUSTABLE ACK.TIMEOUT: 500:MSEC;
                ADJUSTABLE HEARTBEAT.INTERVAL: 1000:MSEC;
                ADJUSTABLE INDICATION.UPDATE.CYCLE: 5;
                ADJUSTABLE STALE.DATA.TIMEOUT: 3000:MSEC;
                ADJUSTABLE CLOCK.MASTER: 1;

                OUTPUT:
                    MII.20.10.BO1,   MII.20.10.BO2,   MII.20.10.BO3,   MII.20.10.BO4;

                INPUT:
                    MII.20.10.BI1,   MII.20.10.BI2,   MII.20.10.BI3,   MII.20.10.BI4;


BOOLEAN BITS
    a, b, c, d, e, f, g, h, i,
    flash1, flash2, flash3, flash4,
    flash21, flash22, flash23, flash24, flash25;

NUMERIC VARIABLES
    n1, n2, n3, n4, n5, n6, n7, n8, n9, n10, n11, n12,
    n21, n22;

TIMER BITS

  flash1:  SET =   500:MSEC   CLEAR =        500:MSEC;
  flash2:  SET =  1600:MSEC   CLEAR = 1600:MSEC;
  flash3:  SET =  2700:MSEC   CLEAR = 2700:MSEC;
  flash4:  SET =  3800:MSEC   CLEAR = 3800:MSEC;

  flash21: SET =     1:SEC    CLEAR =    1:SEC;
```

```
  flash22: SET =     5:SEC    CLEAR =    5:SEC;
  flash23: SET =     8:SEC    CLEAR =    8:SEC;
  flash24: SET =     6:SEC    CLEAR =    6:SEC;
  flash25: SET =     2:SEC         CLEAR =    2:SEC;

LOG
  BITS
       BO.1, BO.2, BO.3, BO.4, BI.1, BI.2, BI.3, BI.4,
       OUT.1, OUT.2, OUT.3, OUT.4, OUT.5, OUT.6,
       IN.1, IN.2, IN.3, IN.4, IN.5, IN.6,
       THEMIXIO.PROXIMITY.SENSOR.1,
THEMIXIO.PROXIMITY.SENSOR.1.INDETERMINATE,
       THEMIXIO.PROXIMITY.SENSOR.2,
THEMIXIO.PROXIMITY.SENSOR.2.INDETERMINATE;

  NUMERICS
            AI.1;

CONFIGURATION

    SYSTEM

       ADJUSTABLE DEBUG_PORT_ADDRESS:      1;
       ADJUSTABLE DEBUG_PORT_BAUDRATE:     9600;
       ADJUSTABLE LOGIC_TIMEOUT:           1000:MSEC;
       APPLICATION.VERSION:                1;

LOGIC BEGIN

       ASSIGN 1 TO CPS.ENABLE;

       ASSIGN IN.1 TO OUT.1;
       ASSIGN IN.2 TO OUT.2;
       ASSIGN IN.3 TO OUT.3;
       ASSIGN IN.4 TO OUT.4;
       ASSIGN IN.5 TO OUT.5;
       ASSIGN IN.6 TO OUT.6;

       NV.ASSIGN THEMIXIO.NV.ANALOG.INPUT.VALID TO
THEMIXIO.NV.ANALOG.INPUT.LED;

       ASSIGN THEMIXIO.ENABLED TO a;
       ASSIGN THEMIXIO.INPUT.ENABLED TO c;
       ASSIGN THEMIXIO.NV.ANALOG.INPUT.ENABLED TO d;
       ASSIGN THEMIXIO.PROXIMITY.SENSOR.1.ENABLED TO e;
```

```
    ASSIGN THEMIXIO.PROXIMITY.SENSOR.2.ENABLED TO f;

    ASSIGN BI.1 TO BO.1;
    ASSIGN BI.2 TO BO.2;
    ASSIGN BI.3 TO BO.3;
    ASSIGN BI.4 TO BO.4;

    ASSIGN THEIN6OUT6.ENABLED TO g;
    ASSIGN THEIN6OUT6.INPUT.ENABLED TO i;

    ASSIGN ~flash1 TO flash1;
    ASSIGN ~flash2 TO flash2;
    ASSIGN ~flash3 TO flash3;
    ASSIGN ~flash4 TO flash4;

    ASSIGN flash1 TO MII.10.20.BO1;
    ASSIGN flash2 TO MII.10.20.BO2;
    ASSIGN flash3 TO MII.10.20.BO3;
    ASSIGN flash4 TO MII.10.20.BO4;

    ASSIGN flash1 TO MII.20.10.BO1;
    ASSIGN flash2 TO MII.20.10.BO2;
    ASSIGN flash3 TO MII.20.10.BO3;
    ASSIGN flash4 TO MII.20.10.BO4;

    ASSIGN ~flash21 TO flash21;
    ASSIGN ~flash22 TO flash22;
    ASSIGN ~flash23 TO flash23;
    ASSIGN ~flash24 TO flash24;
    ASSIGN ~flash25 TO flash25;

    NV.ASSIGN flash22 TO LED.1;
    NV.ASSIGN flash23 TO LED.2;
    NV.ASSIGN flash24 TO LED.3;
    NV.ASSIGN flash25 TO LED.4;

END LOGIC

NUMERIC BEGIN
    BLOCK 1 TRIGGERS ON flash25 AND STALE AFTER 0:SEC;
        EVALUATE AI.1 TO n21;

    END BLOCK

END NUMERIC
```

```
END PROGRAM
```

13.2. LED6 PCB and IN6.OUT6 PCB Application

```
OBJECT_CONTROLLER PROGRAM IN6.OUT6_LED6_TEST.APPL;

SITE.ID.STRING: "PITTSBURGH LAB";
DATE.STAMP: "JANUARY 9, 2007";

INTERFACE

  LOCAL
    BOARD: THESCC
    ADJUSTABLE ENABLE: 1
    TYPE: SCC

    BOARD: THELED6
    ADJUSTABLE ENABLE: 1
    TYPE: LED6
       OUTPUT: SIGNAL.OUTPUT.1, SIGNAL.OUTPUT.2,
             SIGNAL.OUTPUT.3, SIGNAL.OUTPUT.4,
             SIGNAL.OUTPUT.5, SIGNAL.OUTPUT.6;

       SIGNAL.GOOD: SIGNAL.GOOD.1, SIGNAL.GOOD.2,
                 SIGNAL.GOOD.3, SIGNAL.GOOD.4,
                 SIGNAL.GOOD.5, SIGNAL.GOOD.6;

       NV.OUTPUT: NV.OUT.1;
       NV.INPUT: NV.IN.1;
       ADJUSTABLE ENABLE: 1;

    BOARD: THEIN6OUT6
    ADJUSTABLE ENABLE: 1
    TYPE: IN6.OUT6

       OUTPUT:
OUT.1,OUT.2,OUT.3,OUT.4,OUT.5,OUT.6;

       INPUT:
IN.1,IN.2,IN.3,IN.4,IN.5,IN.6;
        ADJUSTABLE ENABLE: 1;


BOOLEAN BITS
```

```
   flash1, flash2, flash3, flash4, flash5,
   a, b, c, d, e, f, g, h,
   out1, out2, out3, out4, out5, out6,
   out7, out8, out9, out10, out11, out12;


TIMER BITS

   flash1:  SET = 500:MSEC     CLEAR = 500:MSEC;
   flash2:  SET =   1:SEC      CLEAR =   1:SEC;
   flash3:  SET =   2:SEC      CLEAR =   2:SEC;
   flash4:  SET =   5:SEC      CLEAR =   5:SEC;
   flash5:  SET =  10:SEC      CLEAR =  10:SEC;

LOG BITS
   LOCAL_IO;

CONFIGURATION

   SYSTEM

      ADJUSTABLE DEBUG_PORT_ADDRESS:      1;
      ADJUSTABLE DEBUG_PORT_BAUDRATE:    9600;
      ADJUSTABLE LOGIC_TIMEOUT:           1000:MSEC;
      APPLICATION.VERSION:                 1;


LOGIC BEGIN

   ASSIGN 1 TO CPS.ENABLE;

   ASSIGN ~flash1 TO flash1;
   ASSIGN ~flash2 TO flash2;
   ASSIGN ~flash3 TO flash3;
   ASSIGN ~flash4 TO flash4;
   ASSIGN ~flash5 TO flash5;

   NV.ASSIGN flash1 TO LED.1;
   NV.ASSIGN flash2 TO LED.2;
   NV.ASSIGN flash3 TO LED.3;
   NV.ASSIGN flash4 TO LED.4;

   ASSIGN NV.IN.1 TO THELED6.RETEST.LEDS;
   NV.ASSIGN flash4 TO NV.OUT.1;
```

```
    ASSIGN IN.1 TO SIGNAL.OUTPUT.1;
    ASSIGN IN.2 TO SIGNAL.OUTPUT.2;
    ASSIGN IN.3 TO SIGNAL.OUTPUT.3;
    ASSIGN IN.4 TO SIGNAL.OUTPUT.4;
    ASSIGN IN.5 TO SIGNAL.OUTPUT.5;
    ASSIGN IN.6 TO SIGNAL.OUTPUT.6;

    ASSIGN SIGNAL.GOOD.1 * SIGNAL.OUTPUT.1 TO OUT.1;
    ASSIGN SIGNAL.GOOD.2 * SIGNAL.OUTPUT.2 TO OUT.2;
    ASSIGN SIGNAL.GOOD.3 * SIGNAL.OUTPUT.3 TO OUT.3;
    ASSIGN SIGNAL.GOOD.4 * SIGNAL.OUTPUT.4 TO OUT.4;
    ASSIGN SIGNAL.GOOD.5 * SIGNAL.OUTPUT.5 TO OUT.5;
    ASSIGN SIGNAL.GOOD.6 * SIGNAL.OUTPUT.6 TO OUT.6;


END LOGIC

END PROGRAM
```

13.3. GPS.MASTER/CLASSC.EMP Example Program

```
/*
      Object Controller Example Application
*/

OBJECT_CONTROLLER Program EXAMPLE;

SITE.ID.STRING: "EXAMPLE PROGRAM";
DATE.STAMP: "MARCH 07, 2008";


INTERFACE

  LOCAL

    BOARD: THESCC                          /* Define and enable */
    ADJUSTABLE ENABLE: 1                          /*  the serial      */
    TYPE: SCC                              /*  communication    */
                                        /*  board.         */

    BOARD: THEIN6OUT6_1
    ADJUSTABLE ENABLE: 1
    TYPE: IN6.OUT6

      OUTPUT: VO0.0, VO0.1, VO0.2, VO0.3, VO0.4, VO0.5;

      INPUT:    VI0.0, VI0.1, VI0.2, VI0.3, VI0.4, VI0.5;
            ADJUSTABLE ENABLE: 1;

    BOARD: THEIN6OUT6_2
    ADJUSTABLE ENABLE: 1
    TYPE: IN6.OUT6

      OUTPUT: VO1.0, VO1.1, VO1.2, VO1.3, VO1.4, VO1.5;

      INPUT:    VI1.0, VI1.1, VI1.2, VI1.3, VI1.4, VI1.5;
            ADJUSTABLE ENABLE: 1;


    COMM

      LINK: CLASSC_EMP                     /* Link name string  */
```

```
    ADJUSTABLE ENABLE: 1                          /* Enable the       */
                                                  /*  CLASSC.EMP link. */
    PROTOCOL: CLASSC.EMP                          /* Type = 8         */
                                                  /* Multiple links are*/
                                                  /*  allowed.        */
    ADJUSTABLE PORT: 1;                           /* 1 - 2; No default */
    ADJUSTABLE BAUD: 9600;                        /* 4800, 9600, 19200,*/
                                                  /* 38400; Dflt 9600  */
    ADJUSTABLE STOPBITS: 1;                       /* 1 or 2; Dflt 1    */
    ADJUSTABLE PARITY: NONE;                      /* NONE, ODD, EVEN,  */
                                                  /* MARK, SPACE;      */
                                                  /* Dflt NONE         */
    ADJUSTABLE POINT.POINT: 1;                    /* 0 - 1; Dflt 1     */
    ADJUSTABLE BROADCAST.CHANGE: 1;               /* 0 - 1; Dflt 0     */
    ADJUSTABLE NO.RESPONSE.TIMEOUT: 1000:MSEC;    /* 30 - 10000;       */
                                                  /* Dflt 1000         */
    ADJUSTABLE EMP.SOURCE.ADDRESS:
       "WIUxxxxxxxx.wayside.up.com";              /*  ASCII string     */
                                                  /*  80 char max.     */
                                                  /*  Dflt is shown.   */
    ADJUSTABLE EMP.TYPE: 20480;                   /* 0 - 65535         */
                                                  /*  Dflt 20480       */
    ADJUSTABLE LINK.FAIL.TIMEOUT: 60000:MSEC;     /* 1000 - 60000;     */
                                                  /* Dflt 60000        */
    ADJUSTABLE MESSAGE.TYPE: 1;                   /* 1 - 65535; Dflt 1 */
    ADJUSTABLE MESSAGE.VERSION: 1;                /* 1 - 255; Dflt 1   */
    ADJUSTABLE WIU.ADDRESS.SIZE: 24;              /* 16 - 32; Dflt 24  */
    ADJUSTABLE MESSAGE.TYPE.SIZE: 6;              /* 4 - 16; Dflt 6    */
    ADJUSTABLE MESSAGE.VERSION.SIZE: 4;           /* 4 - 8;  Dflt 4    */
    ADJUSTABLE MESSAGE.DATA.SIZE: 64;             /* 64 - 184; Dflt 64 */
    ADJUSTABLE MESSAGE.DIGEST.SIZE: 32;           /* 32 - 160; Dflt 32 */
    ADJUSTABLE ENCRYPTED.KEY:
  "EB 1F A0 2E B9 D8 83 72 C7 F1 24 FE 62 2D D6 1C C0 89 F8 40 E5 36 F4 2D";
                                                  /* 8 - 64 hexidecimal*/
                                                  /*  bytes.          */
                                                  /*  Unspecified bytes*/
                                                  /*  filled with 0's; */
                                                  /*  No dflt; Must be */
                                                  /*  specified        */

    ADJUSTABLE WIU.CHANNEL.ADDRESS: 1             /* U_INT32; No dflt  */
                                                  /* Address is        */
                                                  /*  specified as a   */
                                                  /*  decimal number.  */
                                                  /* Up to 3 addresses */
```

```
                                        /*  may be specified */
                                        /*  within a single  */
                                        /*  link.          */

        ADJUSTABLE ENABLE: 1            /* 0 - 1; No dflt    */
        CHANNEL.NAME: MP_88.0;          /* Channel name      */
                                        /*  string          */

        ADJUSTABLE RADIO.CONFIG.STRING:
           "00 00 F0 01 00 00 00 01 00 05 00 01 03 7A 00";
                                        /* Up to 4 string    */
                                        /*  segments each    */
                                        /*  0 to 32          */
                                        /*  hexadecimal bytes*/
                                        /*  in length.      */
                                        /*  Default is the   */
                                        /*  NULL string ("").*/
/*                                       */
/*                                       */

        ADJUSTABLE BROADCAST.INTERVAL: 1000:MSEC;   /* 500 - 60000;      */
                                        /* Dflt 1000         */
        ADJUSTABLE TEST.INTERVAL: 0:MSEC;          /* 0,
                                        /*  10000 - 3600000; */
                                        /*  Dflt 60000       */
                                        /*  (Note that "0"   */
                                        /*   disables the    */
                                        /*   test interval. */
                                        /*   1 - 9999 are    */
                                        /*   invalid.)       */

        OUTPUT:                         /* NOTE: Only outputs*/
                                        /*  are supported.  */
                                        /*  Any attempt to   */
                                        /*  define inputs    */
                                        /*  generates an     */
                                        /*  error. One to   */
                                        /*  30 output bits   */
                                        /*  may be defined. */

           BIT.100, BIT.101, BIT.102, BIT.103, BIT.104,
           BIT.110, BIT.111, BIT.112, BIT.113, BIT.114,
           BIT.120, BIT.121, BIT.122, BIT.123, BIT.124,
           BIT.130, BIT.131, BIT.132, BIT.133, BIT.134,
           BIT.140, BIT.141, BIT.142, BIT.143, BIT.144,
```

```
        BIT.150, BIT.151, BIT.152, BIT.153, BIT.154;


ADJUSTABLE WIU.CHANNEL.ADDRESS: 2

   ADJUSTABLE ENABLE: 1
   CHANNEL.NAME: MP_88.1;
   ADJUSTABLE RADIO.CONFIG.STRING:
      "00 00 F0 01 00 00 00 01 00 05 00 03 03 7A 00"
      "00 00 F0 01 00 00 00 02 00 05 00 05 03 7A 00";
   ADJUSTABLE BROADCAST.INTERVAL: 1000:MSEC;
   ADJUSTABLE TEST.INTERVAL: 0:MSEC;

   OUTPUT:

      BIT.200, BIT.201, BIT.202, BIT.203, BIT.204,
      BIT.210, BIT.211, BIT.212, BIT.213, BIT.214,
      BIT.220, BIT.221, BIT.222, BIT.223, BIT.224,
      BIT.230, BIT.231, BIT.232, BIT.233, BIT.234,
      BIT.240, BIT.241, BIT.242, BIT.243, BIT.244,
      BIT.250, BIT.251, BIT.252, BIT.253, BIT.254;


LINK: GPS_MASTER                        /* Link name string  */

ADJUSTABLE ENABLE: 1                     /* Enable the       */
                                        /*  GPS.MASTER link. */
PROTOCOL: GPS.MASTER                    /* Type = 7         */
ADJUSTABLE PORT: 2;                      /* 1 - 2; No default */
ADJUSTABLE BAUD: 9600;                   /* 4800, 9600, 19200,*/
                                        /* 38400; Dflt 9600  */
ADJUSTABLE STOPBITS: 1;                  /* 1 or 2; Dflt 1    */
ADJUSTABLE PARITY: ODD;                  /* NONE, ODD, EVEN,  */
                                        /* MARK, SPACE;      */
                                        /* Dflt ODD          */
ADJUSTABLE STALE.DATA.TIMEOUT: 300000:MSEC;     /* 5000 - 600000     */
                                        /* Dflt 300000       */
ADJUSTABLE LINK.TIMEOUT: 60000:MSEC;             /* 5000 - 60000;     */
                                        /* Dflt 60000        */
ADJUSTABLE MASTER.TIMEOUT: 2000:MSEC;        /* 30 - 10000;       */
                                        /* Dflt 1100         */
ADJUSTABLE UTC.CLOCK.RECOVERY.WINDOW: 3;     /* 3 - 30 seconds.  */
                                        /*  dflt 3 seconds   */
ADJUSTABLE INTERBYTE.TIMEOUT: 0:MSEC;        /* 0 - 100; Dflt 0   */
ADJUSTABLE DYNAMICS.CODE: 4;                  /* 1 - 4; Dflt 4     */
```

```
    ADJUSTABLE MINIMUM.SIGNAL: 2.0;                 /* 2.0 to 10.0;      */
                                                    /* Inc 1.0; Dflt 2.0 */
                                                    /* FLOAT             */
    ADJUSTABLE MAXIMUM.PDOP: 8.0;                   /* 4.0 to 30.0;      */
                                                    /* Inc 1.0; Dflt 8.0 */
                                                    /* FLOAT             */

    ADJUSTABLE POINT.POINT:   1;                    /* 0 - 1; Dflt 1     */

CONFIGURATION

  SYSTEM

    FIXED DEBUG_PORT_ADDRESS:      1;
    FIXED DEBUG_PORT_BAUDRATE:     9600;
    ADJUSTABLE LOGIC_TIMEOUT:      500:MSEC;
    EVENT.THRESHOLD.39: 2;

LOGIC BEGIN

    ASSIGN       1                  TO    CPS.ENABLE;

    ASSIGN       VI0.0              TO    BIT.100;
    ASSIGN       VI0.1              TO    BIT.101;
    ASSIGN       VI0.2              TO    BIT.102;
    ASSIGN       VI0.3              TO    BIT.103;
    ASSIGN       VI0.4              TO    BIT.104;
    ASSIGN       VI0.5              TO    BIT.154;
    NV.ASSIGN      VI0.5            TO    LED.1;

    ASSIGN       VI1.0              TO    BIT.200;
    ASSIGN       VI1.1              TO    BIT.201;
    ASSIGN       VI1.2              TO    BIT.202;
    ASSIGN       VI1.3              TO    BIT.203;
    ASSIGN       VI1.4              TO    BIT.204;
    ASSIGN       VI1.5              TO    BIT.254;
    NV.ASSIGN    VI1.5              TO    LED.2;

END LOGIC

END PROGRAM
```

13.4. GPS.MASTER/MII.PEER Example Program

```
/*

      Object Controller Test Application

*/


OBJECT_CONTROLLER Program GPS.PEER.TEST;


SITE.ID.STRING: "GPS LAB TEST";

DATE.STAMP: "MARCH 4, 2009";



INTERFACE


  LOCAL


    BOARD: THESCC
    ADJUSTABLE ENABLE: 1
    TYPE: SCC

    BOARD: THEMIXIO
    ADJUSTABLE ENABLE: 1
    TYPE: MIXIO

        OUTPUT:     BO.1,  BO.2,  BO.3,  BO.4;

        INPUT:      BI.1,  BI.2,  BI.3,  BI.4;
              ADJUSTABLE ENABLE: 1;

        NV.ANALOG.INPUT: AI.1;
              ADJUSTABLE ENABLE: 1;
              ADJUSTABLE MINIMUM.THRESHOLD: 12.2;  //0.0-30.0
              ADJUSTABLE MAXIMUM.THRESHOLD: 16.7;  //0.0-30.0
```

```
    PROXIMITY.SENSOR.1:
        ADJUSTABLE ENABLE: 0;

    PROXIMITY.SENSOR.2:
        ADJUSTABLE ENABLE: 0;



COMM

    LINK: GPS_MASTER

    ADJUSTABLE ENABLE: 1
    PROTOCOL: GPS.MASTER
    ADJUSTABLE PORT: 2;
    ADJUSTABLE BAUD: 9600;
    ADJUSTABLE STOPBITS: 1;
    ADJUSTABLE PARITY: ODD;
    ADJUSTABLE STALE.DATA.TIMEOUT: 350000:MSEC;
    ADJUSTABLE LINK.TIMEOUT: 60000:MSEC;
    ADJUSTABLE MASTER.TIMEOUT: 2000:MSEC;
    ADJUSTABLE POLLING.INTERVAL: 800:MSEC;
    ADJUSTABLE UTC.CLOCK.RECOVERY.WINDOW: 4;
    ADJUSTABLE INTERBYTE.TIMEOUT: 0:MSEC;
    ADJUSTABLE DYNAMICS.CODE: 4;
    ADJUSTABLE MINIMUM.SIGNAL: 2.0;
    ADJUSTABLE MAXIMUM.PDOP: 8.0;
    ADJUSTABLE POSITION.LATITUDE: 40.43389623281269;
    ADJUSTABLE POSITION.LONGITUDE: -79.9674354574159;
    ADJUSTABLE POSITION.ALTITUDE: 201.832884109579;
    ADJUSTABLE POINT.POINT:   1;


    LINK: MII_PEER1

        ADJUSTABLE ENABLE: 1
        PROTOCOL: MII.PEER
        ADJUSTABLE PORT: 1;
        ADJUSTABLE BAUD: 38400;
        ADJUSTABLE STOPBITS: 1;
        ADJUSTABLE PARITY: NONE;
        ADJUSTABLE KEY.ON.DELAY: 0;
        ADJUSTABLE KEY.OFF.DELAY: 0;
```

```
ADJUSTABLE GRANT.DELAY: 10:MSEC;
ADJUSTABLE POINT.POINT: 1;

// VITAL STATION
ADJUSTABLE MII.ADDRESS: 270

ADJUSTABLE ENABLE: 1
STATION.NAME: STATION_270;
ADJUSTABLE PEER.ADDRESS: 160;
ADJUSTABLE TIME.STAMP: 1;

ADJUSTABLE ACK.TIMEOUT: 1000:MSEC;
ADJUSTABLE HEARTBEAT.INTERVAL: 2000:MSEC;
ADJUSTABLE INDICATION.UPDATE.CYCLE: 2;
ADJUSTABLE STALE.DATA.TIMEOUT: 30000:MSEC;
ADJUSTABLE CLOCK.MASTER: 1;
ADJUSTABLE UTC.TIME.STAMP: 1;

OUTPUT:
        MII.270.160.BO1;

INPUT:
        MII.270.160.BI1;

// VITAL STATION
ADJUSTABLE MII.ADDRESS: 10

ADJUSTABLE ENABLE: 1
STATION.NAME: STATION_10;
ADJUSTABLE PEER.ADDRESS: 20;
ADJUSTABLE TIME.STAMP: 1;

ADJUSTABLE ACK.TIMEOUT: 1000:MSEC;
ADJUSTABLE HEARTBEAT.INTERVAL: 2000:MSEC;
ADJUSTABLE INDICATION.UPDATE.CYCLE: 2;
ADJUSTABLE STALE.DATA.TIMEOUT: 30000:MSEC;
ADJUSTABLE CLOCK.MASTER: 1;
ADJUSTABLE UTC.TIME.STAMP: 0;

OUTPUT:
        MII.10.20.BO1;

INPUT:
        MII.10.20.BI1;
```

```
BOOLEAN BITS
        flash1;

TIMER BITS

        flash1:         SET =   2800:MSEC   CLEAR =   2800:MSEC;


CONFIGURATION
   SYSTEM

       FIXED DEBUG_PORT_ADDRESS:    1;
       FIXED DEBUG_PORT_BAUDRATE:   9600;
       ADJUSTABLE LOGIC_TIMEOUT:    1500:MSEC;
       APPLICATION.VERSION:         5;

LOGIC BEGIN

   ASSIGN 1 TO CPS.ENABLE;

   NV.ASSIGN UTC.CLOCK.VALID TO LED.3;
   NV.ASSIGN UTC.CLOCK.INVALID TO LED.4;

   ASSIGN ~flash1 TO flash1;

   ASSIGN flash1 TO MII.270.160.BO1;
   ASSIGN ~flash1 TO MII.10.20.BO1;

   NV.ASSIGN MII.270.160.BO1 TO LED.1;
   NV.ASSIGN MII.10.20.BO1 TO LED.2;

END LOGIC

END PROGRAM
```

14. SAMPLE LISTING FILE

A sample listing file is included in this section.

14.1. Sample Listing File

Union Switch & Signal Inc. Object Controller Listing File [Version 1.00]

Application: SAMPLE.OBJECT_CONTROLLER.APP compiled on Tue Sep 12 15:34:41 2006

CRC = 8bde Checksum = 8298

```
 1  OBJECT_CONTROLLER PROGRAM SAMPLE.OBJECT_CONTROLLER.APP;
 2
 3  SITE.ID.STRING: "PITTSBURGH LAB";
 4  DATE.STAMP: "JUNE 7, 2006";
 5
 6  INTERFACE
 7
 8    LOCAL
 9
10      BOARD: THESCC
11      ADJUSTABLE ENABLE: 1
12      TYPE: SCC
13
14      BOARD: THEIN6OUT6
15      ADJUSTABLE ENABLE: 1
16      TYPE: IN6.OUT6
17
18        OUTPUT:  OUT.1,OUT.2,OUT.3,OUT.4,OUT.5,OUT.6;
19
20        INPUT:     IN.1,IN.2,IN.3,IN.4,IN.5,IN.6;
21              ADJUSTABLE ENABLE: 1;
22
23      BOARD: THEMIXIO
24      ADJUSTABLE ENABLE: 1
25      TYPE: MIXIO
26
27        OUTPUT:  BO.1,  BO.2,  BO.3,  BO.4;
28
29        INPUT:     BI.1,  BI.2,  BI.3,  BI.4;
30              ADJUSTABLE ENABLE: 1;
31
32        NV.ANALOG.INPUT: AI.1;
33              ADJUSTABLE ENABLE: 1;
34              ADJUSTABLE MINIMUM.THRESHOLD: 12.2;  //0.0-30.0
35              ADJUSTABLE MAXIMUM.THRESHOLD: 16.7;  //0.0-30.0
36
```

```
 37         PROXIMITY.SENSOR.1:
 38               ADJUSTABLE ENABLE: 1;
 39
 40         PROXIMITY.SENSOR.2:
 41               ADJUSTABLE ENABLE: 1;
 42
 43
 44
 45         COMM
 46
 47               LINK: MII_PEER1
 48
 49               ADJUSTABLE ENABLE: 1
 50               PROTOCOL: MII.PEER
 51               ADJUSTABLE PORT: 1;
 52               ADJUSTABLE BAUD: 38400;
 53               ADJUSTABLE STOPBITS: 1;
 54               ADJUSTABLE PARITY: NONE;
 55               ADJUSTABLE KEY.ON.DELAY: 0;
 56               ADJUSTABLE KEY.OFF.DELAY: 0;
 57               ADJUSTABLE GRANT.DELAY: 10:MSEC;
 58               ADJUSTABLE POINT.POINT: 1;
 59   //          ADJUSTABLE MII.DEBUG.PORT.ADDRESS: 0;
 60
 61               // VITAL STATION
 62               ADJUSTABLE MII.ADDRESS: 10
 63
 64                    ADJUSTABLE ENABLE: 1
 65                    STATION.NAME: STATION_1;
 66                    ADJUSTABLE PEER.ADDRESS: 20;
 67                    ADJUSTABLE TIME.STAMP: 1;
 68
 69                    ADJUSTABLE ACK.TIMEOUT: 500:MSEC;
 70                    ADJUSTABLE HEARTBEAT.INTERVAL: 1000:MSEC;
 71                    ADJUSTABLE INDICATION.UPDATE.CYCLE: 5;
 72                    ADJUSTABLE STALE.DATA.TIMEOUT: 3000:MSEC;
 73                    ADJUSTABLE CLOCK.MASTER: 1;
 74
 75                    OUTPUT:
 76                         MII.10.20.BO1,   MII.10.20.BO2,   MII.10.20.BO3,
MII.10.20.BO4;
 77
 78                    INPUT:
 79                         MII.10.20.BI1,   MII.10.20.BI2,   MII.10.20.BI3,   MII.10.20.BI4;
 80
 81
 82               LINK: MII_PEER2
 83
 84               ADJUSTABLE ENABLE: 1
```

```
 85              PROTOCOL: MII.PEER
 86              ADJUSTABLE PORT: 2;
 87              ADJUSTABLE BAUD: 38400;
 88              ADJUSTABLE STOPBITS: 1;
 89              ADJUSTABLE PARITY: NONE;
 90              ADJUSTABLE KEY.ON.DELAY: 0;
 91              ADJUSTABLE KEY.OFF.DELAY: 0;
 92              ADJUSTABLE GRANT.DELAY: 10:MSEC;
 93              ADJUSTABLE POINT.POINT: 1;
 94   //         ADJUSTABLE MII.DEBUG.PORT.ADDRESS: 0;
 95
 96              // VITAL STATION
 97              ADJUSTABLE MII.ADDRESS: 20
 98
 99                  ADJUSTABLE ENABLE: 1
100                  STATION.NAME: STATION_2;
101                  ADJUSTABLE PEER.ADDRESS: 10;
102                  ADJUSTABLE TIME.STAMP: 1;
103
104                  ADJUSTABLE ACK.TIMEOUT: 500:MSEC;
105                  ADJUSTABLE HEARTBEAT.INTERVAL: 1000:MSEC;
106                  ADJUSTABLE INDICATION.UPDATE.CYCLE: 5;
107                  ADJUSTABLE STALE.DATA.TIMEOUT: 3000:MSEC;
108                  ADJUSTABLE CLOCK.MASTER: 1;
109
110                  OUTPUT:
111                      MII.20.10.BO1,   MII.20.10.BO2,   MII.20.10.BO3,
MII.20.10.BO4;
112
113                  INPUT:
114                      MII.20.10.BI1,   MII.20.10.BI2,   MII.20.10.BI3,   MII.20.10.BI4;
115
116
117   BOOLEAN BITS
118       a, b, c, d, e, f, g, h, i,
119       flash1, flash2, flash3, flash4,
120       flash21, flash22, flash23, flash24, flash25;
121
122   NUMERIC VARIABLES
123       n1, n2, n3, n4, n5, n6, n7, n8, n9, n10, n11, n12,
124       n21, n22;
125
126   TIMER BITS
127
128    flash1:  SET =    500:MSEC   CLEAR =      500:MSEC;
 -1-
129    flash2:  SET =   1600:MSEC   CLEAR = 1600:MSEC;
 -2-
130    flash3:  SET =   2700:MSEC   CLEAR = 2700:MSEC;
```

```
  -3-
 131     flash4:   SET =   3800:MSEC   CLEAR = 3800:MSEC;
  -4-
 132
 133     flash21: SET =     1:SEC    CLEAR =    1:SEC;
  -5-
 134     flash22:        SET =     5:SEC    CLEAR =    5:SEC;
  -6-
 135     flash23:        SET =     8:SEC    CLEAR =    8:SEC;
  -7-
 136     flash24:        SET =     6:SEC    CLEAR =    6:SEC;
  -8-
137     flash25:  SET =     2:SEC     CLEAR =    2:SEC;
  -9-
 138
 139
 140
 141    LOG
 142     BITS
 143         BO.1, BO.2, BO.3, BO.4, BI.1, BI.2, BI.3, BI.4,
 144         OUT.1, OUT.2, OUT.3, OUT.4, OUT.5, OUT.6,
 145         IN.1, IN.2, IN.3, IN.4, IN.5, IN.6,
 146         THEMIXIO.PROXIMITY.SENSOR.1,
THEMIXIO.PROXIMITY.SENSOR.1.INDETERMINATE,
 147         THEMIXIO.PROXIMITY.SENSOR.2,
THEMIXIO.PROXIMITY.SENSOR.2.INDETERMINATE;
 148
 149     NUMERICS
 150                 AI.1;
 151
 152
 153    CONFIGURATION
 154
 155       SYSTEM
 156
 157          ADJUSTABLE DEBUG_PORT_ADDRESS:      1;
 158          ADJUSTABLE DEBUG_PORT_BAUDRATE:     9600;
 159          ADJUSTABLE LOGIC_TIMEOUT:           1000:MSEC;
 160          APPLICATION.VERSION:                1;
 161
 162    LOGIC BEGIN
 163
 164         ASSIGN 1 TO CPS.ENABLE;
  -10-
 165
 166         ASSIGN IN.1 TO OUT.1;
  -11-
 167         ASSIGN IN.2 TO OUT.2;
  -12-
```

```
 168        ASSIGN IN.3 TO OUT.3;
  -13-
 169        ASSIGN IN.4 TO OUT.4;
  -14-
 170        ASSIGN IN.5 TO OUT.5;
  -15-
 171        ASSIGN IN.6 TO OUT.6;
  -16-
 172
 173        NV.ASSIGN THEMIXIO.NV.ANALOG.INPUT.VALID TO
THEMIXIO.NV.ANALOG.INPUT.LED;
  -17-
 174
 175        ASSIGN THEMIXIO.ENABLED TO a;
  -18-
 176        ASSIGN THEMIXIO.INPUT.ENABLED TO c;
  -19-
 177        ASSIGN THEMIXIO.NV.ANALOG.INPUT.ENABLED TO d;
  -20-
 178        ASSIGN THEMIXIO.PROXIMITY.SENSOR.1.ENABLED TO e;
  -21-
 179        ASSIGN THEMIXIO.PROXIMITY.SENSOR.2.ENABLED TO f;
  -22-
 180
 181        ASSIGN BI.1 TO BO.1;
  -23-
 182        ASSIGN BI.2 TO BO.2;
  -24-
 183        ASSIGN BI.3 TO BO.3;
  -25-
 184        ASSIGN BI.4 TO BO.4;
  -26-
 185
 186        ASSIGN THEIN6OUT6.ENABLED TO g;
  -27-
 187        ASSIGN THEIN6OUT6.INPUT.ENABLED TO i;
  -28-
 188
 189        ASSIGN ~flash1 TO flash1;
  -29-
 190        ASSIGN ~flash2 TO flash2;
  -30-
 191        ASSIGN ~flash3 TO flash3;
  -31-
 192        ASSIGN ~flash4 TO flash4;
  -32-
 193
 194        ASSIGN flash1 TO MII.10.20.BO1;
  -33-
```

```
195         ASSIGN flash2 TO MII.10.20.BO2;
 -34-
196         ASSIGN flash3 TO MII.10.20.BO3;
 -35-
197         ASSIGN flash4 TO MII.10.20.BO4;
 -36-
198
199         ASSIGN flash1 TO MII.20.10.BO1;
 -37-
200         ASSIGN flash2 TO MII.20.10.BO2;
 -38-
201         ASSIGN flash3 TO MII.20.10.BO3;
 -39-
202         ASSIGN flash4 TO MII.20.10.BO4;
 -40-
203
204         ASSIGN ~flash21 TO flash21;
 -41-
205         ASSIGN ~flash22 TO flash22;
 -42-
206         ASSIGN ~flash23 TO flash23;
 -43-
207         ASSIGN ~flash24 TO flash24;
 -44-
208         ASSIGN ~flash25 TO flash25;
 -45-
209
210         NV.ASSIGN flash22 TO LED.1;
 -46-
211         NV.ASSIGN flash23 TO LED.2;
 -47-
212         NV.ASSIGN flash24 TO LED.3;
 -48-
213         NV.ASSIGN flash25 TO LED.4;
 -49-
214
215    END LOGIC
216
217    NUMERIC BEGIN
218         BLOCK 1 TRIGGERS ON flash25 AND STALE AFTER 0:SEC;
 -50-
219                 EVALUATE AI.1 TO n21;
 -51-
220
221         END BLOCK
222
223    END NUMERIC
224
225
```

```
226    END PROGRAM


*** Created on Tue Sep 12 15:34:39 2006
    by Object Controller Compiler Version 1.00 (N800302-0001)
```

*** Application Image Summary:

Target: Object Controller
Application Image CRC: 8bde
Application Image Checksum: 8298

*** Address Select Jumper Settings:

THESCC: SCC
0 1 2 3 4 5 6 7
1 0 0 0 0 0 0 0

THEIN6OUT6: IN6.OUT6
0 1 2 3 4 5 6 7
0 1 0 0 0 0 0 0

THEMIXIO: MIXIO
0 1 2 3 4 5 6 7
0 0 1 0 0 0 0 0

*** Unassigned User-Defined Output Bits:

None Found

*** Unused User-Defined Input Bits:

121 MII.10.20.BI1	INPUT BIT	
122 MII.10.20.BI2	INPUT BIT	
123 MII.10.20.BI3	INPUT BIT	
124 MII.10.20.BI4	INPUT BIT	
135 MII.20.10.BI1	INPUT BIT	
136 MII.20.10.BI2	INPUT BIT	
137 MII.20.10.BI3	INPUT BIT	
138 MII.20.10.BI4	INPUT BIT	

*** Unused or Unassigned Internal Bits:

139 a	INTERNAL BIT	UNUSED	
140 b	INTERNAL BIT	UNUSED	UNASSIGNED
141 c	INTERNAL BIT	UNUSED	
142 d	INTERNAL BIT	UNUSED	
143 e	INTERNAL BIT	UNUSED	
144 f	INTERNAL BIT	UNUSED	
145 g	INTERNAL BIT	UNUSED	

```
146 h            INTERNAL BIT      UNUSED      UNASSIGNED
147 i            INTERNAL BIT      UNUSED

*** Bit Usage Summary:

            CONTACT     # TIMES USED
             TYPE       AS A TRIGGER
   BIT     ------------ ----------------  #
 # NAME     FRONT  BACK  BLOCK TABLE  CODE  ASGNS  TARG  VITALITY
 1 RESET      0    0     0    0    0    - SYSTEM  VITAL  OUT
 2 QUICK.RESET
             0    0     0    0    0    - SYSTEM  VITAL  OUT
 3 KILL       0    0     0    0    0    - SYSTEM  VITAL  OUT
 4 CPS.ENABLE  0    0     0    0    0    1 SYSTEM  VITAL  OUT
 5 CPS.STATUS  0    0     0    0    0    - SYSTEM  VITAL   IN
 6 USER.RESTRICTED
             0    0     0    0    0    - SYSTEM  VITAL   IN
 7 ERROR.RESTRICTED
             0    0     0    0    0    - SYSTEM  VITAL   IN
 8 CONFIGURE.ERROR
             0    0     0    0    0    - SYSTEM  VITAL   IN
10 CLOCK.FREEZE
             0    0     0    0    0    - SYSTEM  VITAL  OUT
11 CLOCK.SET   0    0     0    0    0    - SYSTEM  VITAL  OUT
12 PEER.CLOCK.SET
             0    0     0    0    0    - SYSTEM  VITAL  OUT
14 LOG.OK      0    0     0    0    0    - SYSTEM   NON   IN
16 LOG.LARGE   0    0     0    0    0    - SYSTEM  VITAL   IN
17 LOG.FULL    0    0     0    0    0    - SYSTEM  VITAL   IN
50 LED.1       0    0     0    0    0    1 SYSTEM   NON  OUT
51 LED.2       0    0     0    0    0    1 SYSTEM   NON  OUT
52 LED.3       0    0     0    0    0    1 SYSTEM   NON  OUT
53 LED.4       0    0     0    0    0    1 SYSTEM   NON  OUT
60 CPS.RESET   0    0     0    0    0    - SYSTEM  VITAL  OUT
65 THESCC.Enabled
             0    0     0    0    0    - SYSTEM  VITAL   IN
66 THESCC.Selective.Shutdown
             0    0     0    0    0    - SYSTEM  VITAL   IN
67 THESCC.Spare.1
             0    0     0    0    0    - SYSTEM  VITAL   IN
68 THESCC.Spare.2
             0    0     0    0    0    - SYSTEM  VITAL   IN
69 THEIN6OUT6.Enabled
             1    0     0    0    0    - SYSTEM  VITAL   IN
70 THEIN6OUT6.Selective.Shutdown
             0    0     0    0    0    - SYSTEM  VITAL   IN
71 THEIN6OUT6.Spare.1
             0    0     0    0    0    - SYSTEM  VITAL   IN
72 THEIN6OUT6.Spare.2
```

```
          0   0    0   0   0   - SYSTEM  VITAL   IN
 73 THEIN6OUT6.Input.Enabled
          1   0    0   0   0   - SYSTEM  VITAL   IN
 74 THEIN6OUT6.Error
          0   0    0   0   0   - SYSTEM  VITAL   IN
 75 OUT.1     0   0    0   0   0   1  ASGN  VITAL  OUT
 76 OUT.2     0   0    0   0   0   1  ASGN  VITAL  OUT
 77 OUT.3     0   0    0   0   0   1  ASGN  VITAL  OUT
 78 OUT.4     0   0    0   0   0   1  ASGN  VITAL  OUT
 79 OUT.5     0   0    0   0   0   1  ASGN  VITAL  OUT
 80 OUT.6     0   0    0   0   0   1  ASGN  VITAL  OUT
 81 IN.1      1   0    0   0   0   -    - VITAL   IN
 82 IN.2      1   0    0   0   0   -    - VITAL   IN
 83 IN.3      1   0    0   0   0   -    - VITAL   IN
 84 IN.4      1   0    0   0   0   -    - VITAL   IN
 85 IN.5      1   0    0   0   0   -    - VITAL   IN
 86 IN.6      1   0    0   0   0   -    - VITAL   IN
 87 THEMIXIO.Enabled
          1   0    0   0   0   - SYSTEM  VITAL   IN
 88 THEMIXIO.Selective.Shutdown
          0   0    0   0   0   - SYSTEM  VITAL   IN
 89 THEMIXIO.Spare.1
          0   0    0   0   0   - SYSTEM  VITAL   IN
 90 THEMIXIO.Spare.2
          0   0    0   0   0   - SYSTEM  VITAL   IN
 91 THEMIXIO.Spare.3
          0   0    0   0   0   - SYSTEM  VITAL   IN
 92 THEMIXIO.Input.Enabled
          1   0    0   0   0   - SYSTEM  VITAL   IN
 93 THEMIXIO.Error
          0   0    0   0   0   - SYSTEM  VITAL   IN
 94 THEMIXIO.NV.Analog.Input.Enabled
          1   0    0   0   0   - SYSTEM  VITAL   IN
 95 THEMIXIO.NV.Analog.Input.Valid
          1   0    0   0   0   - SYSTEM   NON   IN
 96 THEMIXIO.NV.Analog.Input.LED
          0   0    0   0   0   1 SYSTEM   NON  OUT
 97 THEMIXIO.Proximity.Sensor.1
          0   0    0   0   0   - SYSTEM  VITAL   IN
 98 THEMIXIO.Proximity.Sensor.1.Enabled
          1   0    0   0   0   - SYSTEM  VITAL   IN
 99 THEMIXIO.Proximity.Sensor.1.Indeterminate
          0   0    0   0   0   - SYSTEM  VITAL   IN
100 THEMIXIO.Proximity.Sensor.2
          0   0    0   0   0   - SYSTEM  VITAL   IN
101 THEMIXIO.Proximity.Sensor.2.Enabled
          1   0    0   0   0   - SYSTEM  VITAL   IN
102 THEMIXIO.Proximity.Sensor.2.Indeterminate
          0   0    0   0   0   - SYSTEM  VITAL   IN
```

```
 103 BO.1       0    0     0    0    0    1  ASGN  VITAL  OUT
104 BO.2        0    0     0    0    0    1  ASGN  VITAL  OUT
 105 BO.3       0    0     0    0    0    1  ASGN  VITAL  OUT
 106 BO.4       0    0     0    0    0    1  ASGN  VITAL  OUT
 107 BI.1       1    0     0    0    0    -    - VITAL   IN
 108 BI.2       1    0     0    0    0    -    - VITAL   IN
 109 BI.3       1    0     0    0    0    -    - VITAL   IN
 110 BI.4       1    0     0    0    0    -    - VITAL   IN
 111 MII_PEER1.Enabled
            0    0     0    0    0    - SYSTEM  VITAL   IN
 112 MII_PEER1.Disable
            0    0     0    0    0    - SYSTEM  VITAL  OUT
 113 MII_PEER1.STATION_1.Enabled
            0    0     0    0    0    - SYSTEM  VITAL   IN
 114 MII_PEER1.STATION_1.Status
            0    0     0    0    0    - SYSTEM  VITAL   IN
 115 MII_PEER1.STATION_1.Inputs.Received
            0    0     0    0    0    - SYSTEM  VITAL   IN
 116 MII_PEER1.STATION_1.Disable
            0    0     0    0    0    - SYSTEM  VITAL  OUT
 117 MII.10.20.BO1
            0    0     0    0    0    1  ASGN  VITAL  OUT
 118 MII.10.20.BO2
            0    0     0    0    0    1  ASGN  VITAL  OUT
 119 MII.10.20.BO3
            0    0     0    0    0    1  ASGN  VITAL  OUT
 120 MII.10.20.BO4
            0    0     0    0    0    1  ASGN  VITAL  OUT
 121 MII.10.20.BI1
            0    0     0    0    0    -    - VITAL   IN
 122 MII.10.20.BI2
            0    0     0    0    0    -    - VITAL   IN
 123 MII.10.20.BI3
            0    0     0    0    0    -    - VITAL   IN
 124 MII.10.20.BI4
            0    0     0    0    0    -    - VITAL   IN
 125 MII_PEER2.Enabled
            0    0     0    0    0    - SYSTEM  VITAL   IN
 126 MII_PEER2.Disable
            0    0     0    0    0    - SYSTEM  VITAL  OUT
 127 MII_PEER2.STATION_2.Enabled
            0    0     0    0    0    - SYSTEM  VITAL   IN
 128 MII_PEER2.STATION_2.Status
            0    0     0    0    0    - SYSTEM  VITAL   IN
 129 MII_PEER2.STATION_2.Inputs.Received
            0    0     0    0    0    - SYSTEM  VITAL   IN
 130 MII_PEER2.STATION_2.Disable
            0    0     0    0    0    - SYSTEM  VITAL  OUT
 131 MII.20.10.BO1
```

```
            0    0    0    0    0    1  ASGN  VITAL  OUT
132 MII.20.10.BO2
            0    0    0    0    0    1  ASGN  VITAL  OUT
133 MII.20.10.BO3
            0    0    0    0    0    1  ASGN  VITAL  OUT
134 MII.20.10.BO4
            0    0    0    0    0    1  ASGN  VITAL  OUT
135 MII.20.10.BI1
            0    0    0    0    0    -    - VITAL  IN
136 MII.20.10.BI2
            0    0    0    0    0    -    - VITAL  IN
137 MII.20.10.BI3
            0    0    0    0    0    -    - VITAL  IN
138 MII.20.10.BI4
            0    0    0    0    0    -    - VITAL  IN
139 a       0    0    0    0    0    1  ASGN  VITAL  INT
140 b       0    0    0    0    0    -    - VITAL  INT
141 c       0    0    0    0    0    1  ASGN  VITAL  INT
142 d       0    0    0    0    0    1  ASGN  VITAL  INT
143 e       0    0    0    0    0    1  ASGN  VITAL  INT
144 f       0    0    0    0    0    1  ASGN  VITAL  INT
145 g       0    0    0    0    0    1  ASGN  VITAL  INT
146 h       0    0    0    0    0    -    - VITAL  INT
147 i       0    0    0    0    0    1  ASGN  VITAL  INT
148 flash1  2    1    0    0    0    1  ASGN  VITAL  INT
149 flash2  2    1    0    0    0    1  ASGN  VITAL  INT
150 flash3  2    1    0    0    0    1  ASGN  VITAL  INT
151 flash4  2    1    0    0    0    1  ASGN  VITAL  INT
152 flash21 0    1    0    0    0    1  ASGN  VITAL  INT
153 flash22 1    1    0    0    0    1  ASGN  VITAL  INT
154 flash23 1    1    0    0    0    1  ASGN  VITAL  INT
155 flash24 1    1    0    0    0    1  ASGN  VITAL  INT
156 flash25 1    1    1    0    0    1  ASGN  VITAL  INT
157 EVALUATE.MATH.ERROR.1
            0    0    0    0    0    - SYSTEM  VITAL  INT


*** Numeric Usage Summary:

  # NAME                MINIMUM    MAXIMUM     ERROR    INITIAL EVAL  TARGET  VITAL
158 CLOCK.MONTH         -2147483648 2147483647        0         0   -  SYSTEM  VITAL
OUT
159 CLOCK.DAY           -2147483648 2147483647        0         0   -  SYSTEM  VITAL  OUT
160 CLOCK.YEAR          -2147483648 2147483647        0         0   -  SYSTEM  VITAL  OUT
161 CLOCK.HOUR          -2147483648 2147483647        0         0   -  SYSTEM  VITAL
OUT
162 CLOCK.MINUTE        -2147483648 2147483647        0         0   -  SYSTEM  VITAL
OUT
```

```
 163 CLOCK.SECOND        -2147483648 2147483647        0        0   - SYSTEM  VITAL
OUT
 164 APP.CRC            -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
 165 APP.VERSION        -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
166 EXEC.CRC            -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
 167 SYSTEM.LOAD        -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
 168 CONFIG.CRC         -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
 169 NUMERIC.SPARE.1    -2147483648 2147483647        0        0   - SYSTEM  VITAL
IN
 170 NUMERIC.SPARE.2    -2147483648 2147483647        0        0   - SYSTEM  VITAL
IN
 171 AI.1               -2147483648 2147483647        0        0   -     -   NON   IN
 175 n1                 -2147483648 2147483647        0        0   -     -  VITAL  INT
 176 n2                 -2147483648 2147483647        0        0   -     -  VITAL  INT
 177 n3                 -2147483648 2147483647        0        0   -     -  VITAL  INT
 178 n4                 -2147483648 2147483647        0        0   -     -  VITAL  INT
 179 n5                 -2147483648 2147483647        0        0   -     -  VITAL  INT
 180 n6                 -2147483648 2147483647        0        0   -     -  VITAL  INT
 181 n7                 -2147483648 2147483647        0        0   -     -  VITAL  INT
 182 n8                 -2147483648 2147483647        0        0   -     -  VITAL  INT
 183 n9                 -2147483648 2147483647        0        0   -     -  VITAL  INT
 184 n10                -2147483648 2147483647        0        0   -     -  VITAL  INT
 185 n11                -2147483648 2147483647        0        0   -     -  VITAL  INT
 186 n12                -2147483648 2147483647        0        0   -     -  VITAL  INT
 187 n21                -2147483648 2147483647        0        0   1   ASGN  VITAL  INT
 188 n22                -2147483648 2147483647        0        0   -     -  VITAL  INT

 *** Board Summary:

    THESCC:  SCC
      THESCC.Enabled:  1 (Vital Adjustable)
      THESCC.Selective.Shutdown:  0 (Fixed)

    THEIN6OUT6:  IN6.OUT6
      THEIN6OUT6.Enabled:  1 (Vital Adjustable)
      THEIN6OUT6.Selective.Shutdown:  0 (Fixed)
      THEIN6OUT6.Input.Enabled:  1 (Vital Adjustable)

    THEMIXIO:  MIXIO
      THEMIXIO.Enabled:  1 (Vital Adjustable)
      THEMIXIO.Selective.Shutdown:  0 (Fixed)
      THEMIXIO.Input.Enabled:  1 (Vital Adjustable)
      THEMIXIO.NV.Analog.Input.Enabled:  1 (Vital Adjustable)
      THEMIXIO.Minimum.Threshold:  122 (Non-vital Adjustable)
      THEMIXIO.Maximum.Threshold:  167 (Non-vital Adjustable)
      THEMIXIO.Proximity.Sensor.1.Enabled:  1 (Vital Adjustable)
      THEMIXIO.Proximity.Sensor.2.Enabled:  1 (Vital Adjustable)

 *** Link Summary:
```

MII_PEER1: MII Peer
MII_PEER1.Enabled: 1 (Vital Adjustable)
Point.Point: 1 (Vital Adjustable)
Port: 1 (Vital Adjustable)
BAUD: 38400 (Non-vital Adjustable)
StopBits: 1 (Non-vital Adjustable)
Parity: 0 (Non-vital Adjustable)
Key.On.Delay: 0 (Non-vital Adjustable)
Key.Off.Delay: 0 (Non-vital Adjustable)
Debug.Port.Address.Type: 0 (Fixed)
Debug.Port.Address: 0x0 (Fixed)
Grant.Delay: 10 (Non-vital Adjustable)
MII_PEER1.STATION_1.Enabled: 1 (Vital Adjustable)
MII_PEER1.STATION_1.TIME.STAMP: 1 (Vital Adjustable)
MII_PEER1.STATION_1.Station.Address.Type: 1 (Fixed)
MII_PEER1.STATION_1.Station.Address: 655360 (Vital Adjustable)
MII_PEER1.STATION_1.PEER.ADDRESS: 0 (Vital Adjustable)
MII_PEER1.STATION_1.Stale.Data.Timeout: 3000 (Vital Adjustable)
MII_PEER1.STATION_1.ACK.TIMEOUT: 500 (Vital Adjustable)
MII_PEER1.STATION_1.HEARTBEAT.INTERVAL: 1000 (Vital Adjustable)
MII_PEER1.STATION_1.INDICATION.UPDATE.CYCLE: 5 (Vital Adjustable)
MII_PEER1.STATION_1.CLOCK.MASTER: 1 (Vital Adjustable)

MII_PEER2: MII Peer
MII_PEER2.Enabled: 1 (Vital Adjustable)
Point.Point: 1 (Vital Adjustable)
Port: 2 (Vital Adjustable)
BAUD: 38400 (Non-vital Adjustable)
StopBits: 1 (Non-vital Adjustable)
Parity: 0 (Non-vital Adjustable)
Key.On.Delay: 0 (Non-vital Adjustable)
Key.Off.Delay: 0 (Non-vital Adjustable)
Debug.Port.Address.Type: 0 (Fixed)
Debug.Port.Address: 0x0 (Fixed)
Grant.Delay: 10 (Non-vital Adjustable)
MII_PEER2.STATION_2.Enabled: 1 (Vital Adjustable)
MII_PEER2.STATION_2.TIME.STAMP: 1 (Vital Adjustable)
MII_PEER2.STATION_2.Station.Address.Type: 1 (Fixed)
MII_PEER2.STATION_2.Station.Address: 1310720 (Vital Adjustable)
MII_PEER2.STATION_2.PEER.ADDRESS: 0 (Vital Adjustable)
MII_PEER2.STATION_2.Stale.Data.Timeout: 3000 (Vital Adjustable)
MII_PEER2.STATION_2.ACK.TIMEOUT: 500 (Vital Adjustable)
MII_PEER2.STATION_2.HEARTBEAT.INTERVAL: 1000 (Vital Adjustable)
MII_PEER2.STATION_2.INDICATION.UPDATE.CYCLE: 5 (Vital Adjustable)
MII_PEER2.STATION_2.CLOCK.MASTER: 1 (Vital Adjustable)

*** System Level Configuration Parameters:

ApplicationChecksum: 0 (Vital Adjustable)

ExecutiveChecksum: 0 (Vital Adjustable)
Executive.Version: 0 (Fixed)
Application.Version: 1 (Fixed)
Event.Threshold.1: 1 (Non-vital Adjustable)
Event.Threshold.2: 1 (Non-vital Adjustable)
Event.Threshold.3: 1 (Non-vital Adjustable)
Event.Threshold.4: 1 (Non-vital Adjustable)
Event.Threshold.5: 1 (Non-vital Adjustable)
Event.Threshold.6: 1 (Non-vital Adjustable)
Event.Threshold.7: 1 (Non-vital Adjustable)
Event.Threshold.8: 1 (Non-vital Adjustable)
Event.Threshold.9: 1 (Non-vital Adjustable)
Event.Threshold.10: 1 (Non-vital Adjustable)
Event.Threshold.11: 1 (Non-vital Adjustable)
Event.Threshold.12: 1 (Non-vital Adjustable)
Event.Threshold.13: 1 (Non-vital Adjustable)
Event.Threshold.14: 1 (Non-vital Adjustable)
Event.Threshold.15: 1 (Non-vital Adjustable)
Event.Threshold.16: 1 (Non-vital Adjustable)
Event.Threshold.17: 1 (Non-vital Adjustable)
Event.Threshold.18: 1 (Non-vital Adjustable)
Event.Threshold.19: 1 (Non-vital Adjustable)
Event.Threshold.20: 1 (Non-vital Adjustable)
Event.Threshold.21: 1 (Non-vital Adjustable)
Event.Threshold.22: 1 (Non-vital Adjustable)
Event.Threshold.23: 1 (Non-vital Adjustable)
Event.Threshold.24: 1 (Non-vital Adjustable)
Event.Threshold.25: 1 (Non-vital Adjustable)
Event.Threshold.26: 1 (Non-vital Adjustable)
Event.Threshold.27: 1 (Non-vital Adjustable)
Event.Threshold.28: 1 (Non-vital Adjustable)
Event.Threshold.29: 1 (Non-vital Adjustable)
Event.Threshold.30: 1 (Non-vital Adjustable)
Event.Threshold.31: 1 (Non-vital Adjustable)
Event.Threshold.32: 1 (Non-vital Adjustable)
Event.Threshold.33: 1 (Non-vital Adjustable)
Event.Threshold.34: 1 (Non-vital Adjustable)
Event.Threshold.35: 1 (Non-vital Adjustable)
Event.Threshold.36: 1 (Non-vital Adjustable)
Event.Threshold.37: 1 (Non-vital Adjustable)
Event.Threshold.38: 1 (Non-vital Adjustable)
Event.Threshold.39: 1 (Non-vital Adjustable)
Event.Threshold.40: 1 (Non-vital Adjustable)
Event.Threshold.41: 1 (Non-vital Adjustable)
Event.Threshold.42: 1 (Non-vital Adjustable)
Event.Threshold.43: 1 (Non-vital Adjustable)
Event.Threshold.44: 1 (Non-vital Adjustable)

Event.Threshold.45: 1 (Non-vital Adjustable)

Event.Threshold.46: 1 (Non-vital Adjustable)
Event.Threshold.47: 1 (Non-vital Adjustable)
Event.Threshold.48: 1 (Non-vital Adjustable)
Event.Threshold.49: 1 (Non-vital Adjustable)
Event.Threshold.50: 1 (Non-vital Adjustable)
Event.Threshold.51: 1 (Non-vital Adjustable)
Event.Threshold.52: 1 (Non-vital Adjustable)
Event.Threshold.53: 1 (Non-vital Adjustable)
Event.Threshold.54: 1 (Non-vital Adjustable)
Event.Threshold.55: 1 (Non-vital Adjustable)
Event.Threshold.56: 1 (Non-vital Adjustable)
Event.Threshold.57: 1 (Non-vital Adjustable)
Event.Threshold.58: 1 (Non-vital Adjustable)
Event.Threshold.59: 1 (Non-vital Adjustable)
Event.Threshold.60: 1 (Non-vital Adjustable)
Event.Threshold.61: 1 (Non-vital Adjustable)
Event.Threshold.62: 1 (Non-vital Adjustable)
Event.Threshold.63: 1 (Non-vital Adjustable)
Event.Threshold.64: 1 (Non-vital Adjustable)
Logic.Timeout: 1000 (Vital Adjustable)
Configuration.Compatibility: 0 (Fixed)
PC.Vital.Config.Date: 0 (Vital Adjustable)
PC.NV.Config.Date: 0 (Non-vital Adjustable)
Front.Vital.Config.Date: 0 (Vital Adjustable)
Front.NV.Config.Date: 0 (Non-vital Adjustable)
Password: 0 (Vital Adjustable)
Debug.Port.Address: 1 (Non-vital Adjustable)
Debug.Port.Baudrate: 9600 (Non-vital Adjustable)
Delay.Reset: 0 (Fixed)

14.2. GPS.MASTER/CLASSC.EMP Example Program

Application: EXAMPLE compiled on Thu May 22 14:42:26 2008
CRC = 3e02 Checksum = 60ac Page: 1

```
 1   /*
 2 //        Object Controller Example Application
 3 // */
 4
 5   OBJECT_CONTROLLER Program EXAMPLE;
 6
 7   SITE.ID.STRING: "EXAMPLE PROGRAM";
 8   DATE.STAMP: "MARCH 07, 2008";
 9
10
11    INTERFACE
```

```
 12
 13     LOCAL
 14
 15       BOARD: THESCC                    /* Define and enable */
 16       ADJUSTABLE ENABLE: 1                    /*  the serial      */
 17       TYPE: SCC                       /*  communication    */
 18                                  /*  board.         */
 19
 20       BOARD: THEIN6OUT6_1
 21       ADJUSTABLE ENABLE: 1
 22       TYPE: IN6.OUT6
 23
 24         OUTPUT:  VO0.0, VO0.1, VO0.2, VO0.3, VO0.4, VO0.5;
 25
 26         INPUT:     VI0.0, VI0.1, VI0.2, VI0.3, VI0.4, VI0.5;
 27               ADJUSTABLE ENABLE: 1;
 28
 29       BOARD: THEIN6OUT6_2
 30       ADJUSTABLE ENABLE: 1
 31       TYPE: IN6.OUT6
 32
 33         OUTPUT:  VO1.0, VO1.1, VO1.2, VO1.3, VO1.4, VO1.5;
 34
 35         INPUT:     VI1.0, VI1.1, VI1.2, VI1.3, VI1.4, VI1.5;
 36               ADJUSTABLE ENABLE: 1;
 37
 38
 39       COMM
 40
 41         LINK: CLASSC_EMP                /* Link name string  */
 42
 43         ADJUSTABLE ENABLE: 1                    /* Enable the       */
 44                                  /*  CLASSC.EMP link. */
 45         PROTOCOL: CLASSC.EMP                /* Type = 8         */
 46                                  /* Multiple links are*/
 47                                  /*  allowed.       */
 48         ADJUSTABLE PORT: 1;                     /* 1 - 2; No default */
Application: EXAMPLE compiled on Thu May 22 14:42:26 2008
CRC = 3e02  Checksum = 60ac  Page: 2

 49         ADJUSTABLE BAUD: 9600;                  /* 4800, 9600, 19200,*/
 50                                  /* 38400; Dflt 9600  */
 51         ADJUSTABLE STOPBITS: 1;                 /* 1 or 2; Dflt 1    */
 52         ADJUSTABLE PARITY: NONE;                /* NONE, ODD, EVEN,  */
 53                                  /* MARK, SPACE;      */
 54                                  /* Dflt NONE         */
 55         ADJUSTABLE POINT.POINT: 1;              /* 0 - 1; Dflt 1     */
 56         ADJUSTABLE BROADCAST.CHANGE: 1;         /* 0 - 1; Dflt 0     */
 57         ADJUSTABLE NO.RESPONSE.TIMEOUT: 1000:MSEC;  /* 30 - 10000;       */
```

```
 58                                    /* Dflt 1000        */
 59          ADJUSTABLE EMP.SOURCE.ADDRESS:
 60            "WIUxxxxxxxx.wayside.up.com";       /*  ASCII string     */
 61                                    /*  80 char max.    */
 62                                    /*  Dflt is shown.  */
 63          ADJUSTABLE EMP.TYPE: 20480;       /* 0 - 65535        */
 64                                    /*  Dflt 20480      */
 65          ADJUSTABLE LINK.FAIL.TIMEOUT: 60000:MSEC;  /* 1000 - 60000;     */
 66                                    /* Dflt 60000       */
 67          ADJUSTABLE MESSAGE.TYPE: 1;      /* 1 - 65535; Dflt 1 */
 68          ADJUSTABLE MESSAGE.VERSION: 1;          /* 1 - 255; Dflt 1   */
 69          ADJUSTABLE WIU.ADDRESS.SIZE: 24;        /* 16 - 32; Dflt 24  */
 70          ADJUSTABLE MESSAGE.TYPE.SIZE: 6;        /* 4 - 16; Dflt 6    */
 71          ADJUSTABLE MESSAGE.VERSION.SIZE: 4;  /* 4 - 8;  Dflt 4    */
 72          ADJUSTABLE MESSAGE.DATA.SIZE: 64;       /* 64 - 184; Dflt 64 */
 73          ADJUSTABLE MESSAGE.DIGEST.SIZE: 32;    /* 32 - 160; Dflt 32 */
 74          ADJUSTABLE ENCRYPTED.KEY:
 75       "EB 1F A0 2E B9 D8 83 72 C7 F1 24 FE 62 2D D6 1C C0 89 F8 40 E5 36 F4 2D";
 76                                    /* 8 - 64 hexidecimal*/
 77                                    /*  bytes.          */
 78                                    /*  Unspecified bytes*/
 79                                    /*  filled with 0's; */
 80                                    /*  No dflt; Must be */
 81                                    /*  specified       */
 82
 83          ADJUSTABLE WIU.CHANNEL.ADDRESS: 1  /* U_INT32; No dflt  */
 84                                    /* Address is       */
 85                                    /*  specified as a   */
 86                                    /*  decimal number. */
 87                                    /* Up to 3 addresses */
 88                                    /*  may be specified */
 89                                    /*  within a single  */
 90                                    /*  link.           */
 91
 92             ADJUSTABLE ENABLE: 1               /* 0 - 1; No dflt    */
 93             CHANNEL.NAME: MP_88.0;             /* Channel name      */
 94                                    /*  string          */
 95
 96             ADJUSTABLE RADIO.CONFIG.STRING:
Application: EXAMPLE compiled on Thu May 22 14:42:26 2008
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 97               "00 00 F0 01 00 00 00 01 00 05 00 01 03 7A 00";
 98                                    /* Up to 4 string    */
 99                                    /*  segments each    */
100                                    /*  0 to 32          */
101                                    /*  hexadecimal bytes*/
102                                    /*  in length.      */
103                                    /*  Default is the   */
```

```
104                                     /*  NULL string ("").*/
105    /*                                                      */
106    /*                                                        */
107
108             ADJUSTABLE BROADCAST.INTERVAL: 1000:MSEC;
                                                /* 500 - 60000;      */
109                                     /* Dflt 1000         */
110             ADJUSTABLE TEST.INTERVAL: 0:MSEC;  /* 0,
111 //                                  /*  10000 - 3600000; */
112                                     /*  Dflt 60000       */
113                                     /*  (Note that "0"   */
114                                     /*   disables the    */
115                                     /*   test interval. */
116                                     /*   1 - 9999 are    */
117                                     /*   invalid.)       */
118
119             OUTPUT:                         /* NOTE: Only outputs*/
120                                     /*  are supported.  */
121                                     /*  Any attempt to   */
122                                     /*  define inputs    */
123                                     /*  generates an     */
124                                     /*  error. One to   */
125                                     /*  30 output bits   */
126                                     /*  may be defined. */
127
128               BIT.100, BIT.101, BIT.102, BIT.103, BIT.104,
129               BIT.110, BIT.111, BIT.112, BIT.113, BIT.114,
130               BIT.120, BIT.121, BIT.122, BIT.123, BIT.124,
131               BIT.130, BIT.131, BIT.132, BIT.133, BIT.134,
132               BIT.140, BIT.141, BIT.142, BIT.143, BIT.144,
133               BIT.150, BIT.151, BIT.152, BIT.153, BIT.154;
134
135
136           ADJUSTABLE WIU.CHANNEL.ADDRESS: 2
137
138             ADJUSTABLE ENABLE: 1
139             CHANNEL.NAME: MP_88.1;
140             ADJUSTABLE RADIO.CONFIG.STRING:
141               "00 00 F0 01 00 00 00 01 00 05 00 03 03 7A 00"
142               "00 00 F0 01 00 00 00 02 00 05 00 05 03 7A 00";
143             ADJUSTABLE BROADCAST.INTERVAL: 1000:MSEC;
144             ADJUSTABLE TEST.INTERVAL: 0:MSEC;
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145
146             OUTPUT:
147
148               BIT.200, BIT.201, BIT.202, BIT.203, BIT.204,
```

```
149             BIT.210, BIT.211, BIT.212, BIT.213, BIT.214,
150             BIT.220, BIT.221, BIT.222, BIT.223, BIT.224,
151             BIT.230, BIT.231, BIT.232, BIT.233, BIT.234,
152             BIT.240, BIT.241, BIT.242, BIT.243, BIT.244,
153             BIT.250, BIT.251, BIT.252, BIT.253, BIT.254;
154
155
156         LINK: GPS_MASTER                          /* Link name string  */
157
158         ADJUSTABLE ENABLE: 1                      /* Enable the        */
159                                                   /*  GPS.MASTER link. */
160         PROTOCOL: GPS.MASTER                      /* Type = 7          */
161         ADJUSTABLE PORT: 2;                       /* 1 - 2; No default */
162         ADJUSTABLE BAUD: 9600;                    /* 4800, 9600, 19200,*/
163                                                   /* 38400; Dflt 9600  */
164         ADJUSTABLE STOPBITS: 1;                   /* 1 or 2; Dflt 1    */
165         ADJUSTABLE PARITY: ODD;                   /* NONE, ODD, EVEN,  */
166                                                   /* MARK, SPACE;      */
167                                                   /* Dflt ODD          */
168         ADJUSTABLE STALE.DATA.TIMEOUT: 300000:MSEC;   /* 5000 - 600000     */
169                                                   /* Dflt 300000       */
170         ADJUSTABLE LINK.TIMEOUT: 60000:MSEC;    /* 5000 - 60000;     */
171                                                   /* Dflt 60000        */
172         ADJUSTABLE MASTER.TIMEOUT: 2000:MSEC;     \/* 30 - 10000;       */
173                                                   /* Dflt 1100         */
174         ADJUSTABLE UTC.CLOCK.RECOVERY.WINDOW: 3;    /* 3 - 30 seconds.  */
175                                                   /*  dflt 3 seconds   */
176         ADJUSTABLE INTERBYTE.TIMEOUT: 0:MSEC;          /* 0 - 100; Dflt 0   */
177         ADJUSTABLE DYNAMICS.CODE: 4;                /* 1 - 4; Dflt 4     */
178         ADJUSTABLE MINIMUM.SIGNAL: 2.0;           /* 2.0 to 10.0;      */
179                                                   /* Inc 1.0; Dflt 2.0 */
180                                                   /* FLOAT             */
181         ADJUSTABLE MAXIMUM.PDOP: 8.0;             /* 4.0 to 30.0;      */
182                                                   /* Inc 1.0; Dflt 8.0 */
183                                                   /* FLOAT             */
184
185         ADJUSTABLE POINT.POINT:   1;                      /* 0 - 1; Dflt 1     */
186
187
188   CONFIGURATION
189
190      SYSTEM
191
192         FIXED DEBUG_PORT_ADDRESS:       1;
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193         FIXED DEBUG_PORT_BAUDRATE:      9600;
194         ADJUSTABLE LOGIC_TIMEOUT:       500:MSEC;
```

```
195         EVENT.THRESHOLD.39: 2;
196
197    LOGIC BEGIN
198
199         ASSIGN        1                    TO     CPS.ENABLE;
  -1-
200
201         ASSIGN        VI0.0                TO     BIT.100;
  -2-
202         ASSIGN        VI0.1                TO     BIT.101;
  -3-
203         ASSIGN        VI0.2                TO     BIT.102;
  -4-
204         ASSIGN        VI0.3                TO     BIT.103;
  -5-
205         ASSIGN        VI0.4                TO     BIT.104;
  -6-
206         ASSIGN        VI0.5                TO     BIT.154;
  -7-
207         NV.ASSIGN      VI0.5                 TO     LED.1;
  -8-
208
209         ASSIGN        VI1.0                TO     BIT.200;
  -9-
210         ASSIGN        VI1.1                TO     BIT.201;
  -10-
211         ASSIGN        VI1.2                TO     BIT.202;
  -11-
212         ASSIGN        VI1.3                TO     BIT.203;
  -12-
213         ASSIGN        VI1.4                TO     BIT.204;
  -13-
214         ASSIGN        VI1.5                TO     BIT.254;
  -14-
215         NV.ASSIGN      VI1.5                 TO     LED.2;
  -15-
216
217    END LOGIC
218
219    END PROGRAM
220
```

*** Created on Thu May 22 14:42:26 2008
by Object Controller Compiler Version 1.30 (N800302-0001)
Application: EXAMPLE compiled on Thu May 22 14:42:26 2008
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*** Application Image Summary:

Target: Object Controller
Application Image CRC: 3e02
Application Image Checksum: 60ac

*** Address Select Jumper Settings:

THESCC: SCC
0 1 2 3 4 5 6 7
1 0 0 0 0 0 0 0

THEIN6OUT6_1: IN6.OUT6
0 1 2 3 4 5 6 7
0 1 0 0 0 0 0 0

THEIN6OUT6_2: IN6.OUT6
0 1 2 3 4 5 6 7
0 0 1 0 0 0 0 0

*** Unassigned User-Defined Output Bits:

75 VO0.0 OUTPUT BIT
76 VO0.1 OUTPUT BIT
77 VO0.2 OUTPUT BIT
78 VO0.3 OUTPUT BIT
79 VO0.4 OUTPUT BIT
80 VO0.5 OUTPUT BIT
93 VO1.0 OUTPUT BIT
94 VO1.1 OUTPUT BIT
95 VO1.2 OUTPUT BIT
96 VO1.3 OUTPUT BIT
97 VO1.4 OUTPUT BIT
98 VO1.5 OUTPUT BIT
120 BIT.110 OUTPUT BIT
121 BIT.111 OUTPUT BIT
122 BIT.112 OUTPUT BIT
123 BIT.113 OUTPUT BIT
124 BIT.114 OUTPUT BIT
125 BIT.120 OUTPUT BIT
126 BIT.121 OUTPUT BIT
127 BIT.122 OUTPUT BIT
128 BIT.123 OUTPUT BIT
129 BIT.124 OUTPUT BIT
Application: EXAMPLE compiled on Thu May 22 14:42:26 2008

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130	BIT.130	OUTPUT BIT
131	BIT.131	OUTPUT BIT
132	BIT.132	OUTPUT BIT
133	BIT.133	OUTPUT BIT
134	BIT.134	OUTPUT BIT
135	BIT.140	OUTPUT BIT
136	BIT.141	OUTPUT BIT
137	BIT.142	OUTPUT BIT
138	BIT.143	OUTPUT BIT
139	BIT.144	OUTPUT BIT
140	BIT.150	OUTPUT BIT
141	BIT.151	OUTPUT BIT
142	BIT.152	OUTPUT BIT
143	BIT.153	OUTPUT BIT
150	BIT.210	OUTPUT BIT
151	BIT.211	OUTPUT BIT
152	BIT.212	OUTPUT BIT
153	BIT.213	OUTPUT BIT
154	BIT.214	OUTPUT BIT
155	BIT.220	OUTPUT BIT
156	BIT.221	OUTPUT BIT
157	BIT.222	OUTPUT BIT
158	BIT.223	OUTPUT BIT
159	BIT.224	OUTPUT BIT
160	BIT.230	OUTPUT BIT
161	BIT.231	OUTPUT BIT
162	BIT.232	OUTPUT BIT
163	BIT.233	OUTPUT BIT
164	BIT.234	OUTPUT BIT
165	BIT.240	OUTPUT BIT
166	BIT.241	OUTPUT BIT
167	BIT.242	OUTPUT BIT
168	BIT.243	OUTPUT BIT
169	BIT.244	OUTPUT BIT
170	BIT.250	OUTPUT BIT
171	BIT.251	OUTPUT BIT
172	BIT.252	OUTPUT BIT
173	BIT.253	OUTPUT BIT

*** Unused User-Defined Input Bits:

None Found

*** Unused or Unassigned Internal Bits:

None Found
Application: EXAMPLE compiled on Thu May 22 14:42:26 2008
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*** Bit Usage Summary:

BIT #	NAME	CONTACT FRONT	CONTACT BACK	BLOCK	TABLE	CODE	# TIMES USED AS A TRIGGER ASGNS	TARG	VITALITY
1	RESET	0	0	0	0	0	-	SYSTEM	VITAL OUT
2	QUICK.RESET	0	0	0	0	0	-	SYSTEM	VITAL OUT
3	KILL	0	0	0	0	0	-	SYSTEM	VITAL OUT
4	CPS.ENABLE	0	0	0	0	0	1	SYSTEM	VITAL OUT
5	CPS.STATUS	0	0	0	0	0	-	SYSTEM	VITAL IN
6	USER.RESTRICTED	0	0	0	0	0	-	SYSTEM	VITAL IN
7	ERROR.RESTRICTED	0	0	0	0	0	-	SYSTEM	VITAL IN
8	CONFIGURE.ERROR	0	0	0	0	0	-	SYSTEM	VITAL IN
10	CLOCK.FREEZE	0	0	0	0	0	-	SYSTEM	VITAL OUT
11	CLOCK.SET	0	0	0	0	0	-	SYSTEM	VITAL OUT
12	PEER.CLOCK.SET	0	0	0	0	0	-	SYSTEM	VITAL OUT
14	LOG.OK	0	0	0	0	0	-	SYSTEM	NON IN
16	LOG.LARGE	0	0	0	0	0	-	SYSTEM	VITAL IN
17	LOG.FULL	0	0	0	0	0	-	SYSTEM	VITAL IN
50	LED.1	0	0	0	0	0	1	SYSTEM	NON OUT
51	LED.2	0	0	0	0	0	1	SYSTEM	NON OUT
52	LED.3	0	0	0	0	0	-	SYSTEM	NON OUT
53	LED.4	0	0	0	0	0	-	SYSTEM	NON OUT
60	CPS.RESET	0	0	0	0	0	-	SYSTEM	VITAL OUT
61	UTC.CLOCK.INVALID	0	0	0	0	0	-	SYSTEM	VITAL OUT
62	UTC.CLOCK.VALID	0	0	0	0	0	-	SYSTEM	VITAL OUT
65	THESCC.Enabled	0	0	0	0	0	-	SYSTEM	VITAL IN
66	THESCC.Selective.Shutdown	0	0	0	0	0	-	SYSTEM	VITAL IN
67	THESCC.Spare.1	0	0	0	0	0	-	SYSTEM	VITAL IN
68	THESCC.Spare.2	0	0	0	0	0	-	SYSTEM	VITAL IN

```
 69 THEIN6OUT6_1.Enabled
            0    0    0    0    0    - SYSTEM  VITAL   IN
 70 THEIN6OUT6_1.Selective.Shutdown
Application: EXAMPLE compiled on Thu May 22 14:42:26 2008
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            0    0    0    0    0    - SYSTEM  VITAL   IN
 71 THEIN6OUT6_1.Spare.1
            0    0    0    0    0    - SYSTEM  VITAL   IN
 72 THEIN6OUT6_1.Spare.2
            0    0    0    0    0    - SYSTEM  VITAL   IN
 73 THEIN6OUT6_1.Input.Enabled
            0    0    0    0    0    - SYSTEM  VITAL   IN
 74 THEIN6OUT6_1.Error
            0    0    0    0    0    - SYSTEM  VITAL   IN
 75 VO0.0       0    0    0    0    0    -     - VITAL  OUT
 76 VO0.1       0    0    0    0    0    -     - VITAL  OUT
 77 VO0.2       0    0    0    0    0    -     - VITAL  OUT
 78 VO0.3       0    0    0    0    0    -     - VITAL  OUT
 79 VO0.4       0    0    0    0    0    -     - VITAL  OUT
 80 VO0.5       0    0    0    0    0    -     - VITAL  OUT
 81 VI0.0       1    0    0    0    0    -     - VITAL   IN
 82 VI0.1       1    0    0    0    0    -     - VITAL   IN
 83 VI0.2       1    0    0    0    0    -     - VITAL   IN
 84 VI0.3       1    0    0    0    0    -     - VITAL   IN
 85 VI0.4       1    0    0    0    0    -     - VITAL   IN
 86 VI0.5       2    0    0    0    0    -     - VITAL   IN
 87 THEIN6OUT6_2.Enabled
            0    0    0    0    0    - SYSTEM  VITAL   IN
 88 THEIN6OUT6_2.Selective.Shutdown
            0    0    0    0    0    - SYSTEM  VITAL   IN
 89 THEIN6OUT6_2.Spare.1
            0    0    0    0    0    - SYSTEM  VITAL   IN
 90 THEIN6OUT6_2.Spare.2
            0    0    0    0    0    - SYSTEM  VITAL   IN
 91 THEIN6OUT6_2.Input.Enabled
            0    0    0    0    0    - SYSTEM  VITAL   IN
 92 THEIN6OUT6_2.Error
            0    0    0    0    0    - SYSTEM  VITAL   IN
 93 VO1.0       0    0    0    0    0    -     - VITAL  OUT
 94 VO1.1       0    0    0    0    0    -     - VITAL  OUT
 95 VO1.2       0    0    0    0    0    -     - VITAL  OUT
 96 VO1.3       0    0    0    0    0    -     - VITAL  OUT
 97 VO1.4       0    0    0    0    0    -     - VITAL  OUT
 98 VO1.5       0    0    0    0    0    -     - VITAL  OUT
 99 VI1.0       1    0    0    0    0    -     - VITAL   IN
100 VI1.1       1    0    0    0    0    -     - VITAL   IN
101 VI1.2       1    0    0    0    0    -     - VITAL   IN
102 VI1.3       1    0    0    0    0    -     - VITAL   IN
```

```
 103 VI1.4       1    0     0    0    0    -     - VITAL   IN
 104 VI1.5       2    0     0    0    0    -     - VITAL   IN
 105 CLASSC_EMP.Enabled
              0    0     0    0    0    0    - SYSTEM  VITAL   IN
 106 CLASSC_EMP.Disable
Application: EXAMPLE compiled on Thu May 22 14:42:26 2008
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              0    0     0    0    0    0    - SYSTEM  VITAL  OUT
 107 CLASSC_EMP.MP_88.0.Enabled
              0    0     0    0    0    0    - SYSTEM  VITAL   IN
 108 CLASSC_EMP.MP_88.0.Status
              0    0     0    0    0    0    - SYSTEM  VITAL   IN
 109 CLASSC_EMP.MP_88.0.Inputs.Received
              0    0     0    0    0    0    - SYSTEM  VITAL   IN
 110 CLASSC_EMP.MP_88.0.Disable
              0    0     0    0    0    0    - SYSTEM  VITAL  OUT
 111 CLASSC_EMP.MP_88.1.Enabled
              0    0     0    0    0    0    - SYSTEM  VITAL   IN
 112 CLASSC_EMP.MP_88.1.Status
              0    0     0    0    0    0    - SYSTEM  VITAL   IN
 113 CLASSC_EMP.MP_88.1.Inputs.Received
              0    0     0    0    0    0    - SYSTEM  VITAL   IN
 114 CLASSC_EMP.MP_88.1.Disable
              0    0     0    0    0    0    - SYSTEM  VITAL  OUT
 115 BIT.100     0    0     0    0    0    0    1  ASGN  VITAL  OUT
 116 BIT.101     0    0     0    0    0    0    1  ASGN  VITAL  OUT
 117 BIT.102     0    0     0    0    0    0    1  ASGN  VITAL  OUT
 118 BIT.103     0    0     0    0    0    0    1  ASGN  VITAL  OUT
 119 BIT.104     0    0     0    0    0    0    1  ASGN  VITAL  OUT
 120 BIT.110     0    0     0    0    0    0    -     - VITAL  OUT
 121 BIT.111     0    0     0    0    0    0    -     - VITAL  OUT
 122 BIT.112     0    0     0    0    0    0    -     - VITAL  OUT
 123 BIT.113     0    0     0    0    0    0    -     - VITAL  OUT
 124 BIT.114     0    0     0    0    0    0    -     - VITAL  OUT
 125 BIT.120     0    0     0    0    0    0    -     - VITAL  OUT
 126 BIT.121     0    0     0    0    0    0    -     - VITAL  OUT
 127 BIT.122     0    0     0    0    0    0    -     - VITAL  OUT
 128 BIT.123     0    0     0    0    0    0    -     - VITAL  OUT
 129 BIT.124     0    0     0    0    0    0    -     - VITAL  OUT
 130 BIT.130     0    0     0    0    0    0    -     - VITAL  OUT
 131 BIT.131     0    0     0    0    0    0    -     - VITAL  OUT
 132 BIT.132     0    0     0    0    0    0    -     - VITAL  OUT
 133 BIT.133     0    0     0    0    0    0    -     - VITAL  OUT
 134 BIT.134     0    0     0    0    0    0    -     - VITAL  OUT
 135 BIT.140     0    0     0    0    0    0    -     - VITAL  OUT
 136 BIT.141     0    0     0    0    0    0    -     - VITAL  OUT
 137 BIT.142     0    0     0    0    0    0    -     - VITAL  OUT
 138 BIT.143     0    0     0    0    0    0    -     - VITAL  OUT
```

```
 139 BIT.144     0    0     0    0    0    -     - VITAL  OUT
 140 BIT.150     0    0     0    0    0    -     - VITAL  OUT
 141 BIT.151     0    0     0    0    0    -     - VITAL  OUT
 142 BIT.152     0    0     0    0    0    -     - VITAL  OUT
 143 BIT.153     0    0     0    0    0    -     - VITAL  OUT
 144 BIT.154     0    0     0    0    0    1  ASGN VITAL  OUT
 145 BIT.200     0    0     0    0    0    1  ASGN VITAL  OUT
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 146 BIT.201     0    0     0    0    0    1  ASGN VITAL  OUT
 147 BIT.202     0    0     0    0    0    1  ASGN VITAL  OUT
 148 BIT.203     0    0     0    0    0    1  ASGN VITAL  OUT
 149 BIT.204     0    0     0    0    0    1  ASGN VITAL  OUT
 150 BIT.210     0    0     0    0    0    -     - VITAL  OUT
 151 BIT.211     0    0     0    0    0    -     - VITAL  OUT
 152 BIT.212     0    0     0    0    0    -     - VITAL  OUT
 153 BIT.213     0    0     0    0    0    -     - VITAL  OUT
 154 BIT.214     0    0     0    0    0    -     - VITAL  OUT
 155 BIT.220     0    0     0    0    0    -     - VITAL  OUT
 156 BIT.221     0    0     0    0    0    -     - VITAL  OUT
 157 BIT.222     0    0     0    0    0    -     - VITAL  OUT
 158 BIT.223     0    0     0    0    0    -     - VITAL  OUT
 159 BIT.224     0    0     0    0    0    -     - VITAL  OUT
 160 BIT.230     0    0     0    0    0    -     - VITAL  OUT
 161 BIT.231     0    0     0    0    0    -     - VITAL  OUT
 162 BIT.232     0    0     0    0    0    -     - VITAL  OUT
 163 BIT.233     0    0     0    0    0    -     - VITAL  OUT
 164 BIT.234     0    0     0    0    0    -     - VITAL  OUT
 165 BIT.240     0    0     0    0    0    -     - VITAL  OUT
 166 BIT.241     0    0     0    0    0    -     - VITAL  OUT
 167 BIT.242     0    0     0    0    0    -     - VITAL  OUT
 168 BIT.243     0    0     0    0    0    -     - VITAL  OUT
 169 BIT.244     0    0     0    0    0    -     - VITAL  OUT
 170 BIT.250     0    0     0    0    0    -     - VITAL  OUT
 171 BIT.251     0    0     0    0    0    -     - VITAL  OUT
 172 BIT.252     0    0     0    0    0    -     - VITAL  OUT
 173 BIT.253     0    0     0    0    0    -     - VITAL  OUT
 174 BIT.254     0    0     0    0    0    1  ASGN VITAL  OUT
 175 GPS_MASTER.Enabled
           0    0     0    0    0    - SYSTEM VITAL   IN
 176 GPS_MASTER.Disable
           0    0     0    0    0    - SYSTEM VITAL  OUT


 *** Numeric Usage Summary:

  # NAME                MINIMUM    MAXIMUM     ERROR    INITIAL EVAL  TARGET  VITAL
```

```
 177 CLOCK.MONTH         -2147483648 2147483647        0        0   - SYSTEM  VITAL
OUT
 178 CLOCK.DAY           -2147483648 2147483647        0        0   - SYSTEM  VITAL  OUT
 179 CLOCK.YEAR          -2147483648 2147483647        0        0   - SYSTEM  VITAL  OUT
 180 CLOCK.HOUR          -2147483648 2147483647        0        0   - SYSTEM  VITAL
OUT
 181 CLOCK.MINUTE        -2147483648 2147483647        0        0   - SYSTEM  VITAL
OUT
 182 CLOCK.SECOND        -2147483648 2147483647        0        0   - SYSTEM  VITAL
OUT
 183 APP.CRC             -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
 184 APP.VERSION         -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
 185 EXEC.CRC            -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
 186 SYSTEM.LOAD         -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
Application: EXAMPLE compiled on Thu May 22 14:42:26 2008
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 187 CONFIG.CRC          -2147483648 2147483647        0        0   - SYSTEM  VITAL   IN
 188 NUMERIC.SPARE.1     -2147483648 2147483647        0        0   - SYSTEM  VITAL
IN
 189 NUMERIC.SPARE.2     -2147483648 2147483647        0        0   - SYSTEM  VITAL
IN


 *** Board Summary:

    THESCC:  SCC
      THESCC.Enabled:  1 (Vital Adjustable)
      THESCC.Selective.Shutdown:  0 (Fixed)

    THEIN6OUT6_1:  IN6.OUT6
      THEIN6OUT6_1.Enabled:  1 (Vital Adjustable)
      THEIN6OUT6_1.Selective.Shutdown:  0 (Fixed)
      THEIN6OUT6_1.Input.Enabled:  1 (Vital Adjustable)

    THEIN6OUT6_2:  IN6.OUT6
      THEIN6OUT6_2.Enabled:  1 (Vital Adjustable)
      THEIN6OUT6_2.Selective.Shutdown:  0 (Fixed)
      THEIN6OUT6_2.Input.Enabled:  1 (Vital Adjustable)


 *** Link Summary:

    CLASSC_EMP:  EMP
      CLASSC_EMP.Enabled:  1 (Vital Adjustable)
      Point.Point:  1 (Vital Adjustable)
      Port:  1 (Vital Adjustable)
      BAUD:  9600 (Non-vital Adjustable)
      StopBits:  1 (Non-vital Adjustable)
```

Parity: 0 (Non-vital Adjustable)
Key.On.Delay: 0 (Non-vital Adjustable)
Key.Off.Delay: 0 (Non-vital Adjustable)
No.Response.Timeout: 1000 (Non-vital Adjustable)
Wayside.Data.Address: 0 (Fixed)
Status.Address: 0 (Fixed)
Health.Address: 0 (Fixed)
Local.Address: 0 (Fixed)
EMP.Source.Address: 0 (Non-vital Adjustable)
Link.Fail.Timeout: 60000 (Non-vital Adjustable)
Message.Type: 1 (Vital Adjustable)
Message.Version: 1 (Vital Adjustable)
Interbyte.Timeout: 0 msec (Non-vital Adjustable)
WIU.Address.Size: 24 (Vital Adjustable)
Message.Type.Size: 6 (Vital Adjustable)
Message.Version.Size: 4 (Vital Adjustable)
Message.Digest.Size: 32 (Vital Adjustable)
Message.Data.Size: 64 (Vital Adjustable)
Application: EXAMPLE compiled on Thu May 22 14:42:26 2008
CRC = 3e02 Checksum = 60ac Page: 13

Encrypted.Key: 0 (Vital Adjustable)
Secret.Key: 0 (Vital Adjustable)
Subnet.Mask: 0 (Fixed)
Gateway.Mask: 0 (Non-vital Adjustable)
Data.Port: 4000 (Non-vital Adjustable)
Status.Port: 0 (Non-vital Adjustable)
Health.Port: 0 (Non-vital Adjustable)
EMP.Type: 20480 (Non-vital Adjustable)
Broadcast.Change: 1 (Non-vital Adjustable)
CLASSC_EMP.MP_88.0.Enabled: 1 (Vital Adjustable)
CLASSC_EMP.MP_88.0.Station.Address: 1 (Vital Adjustable)
CLASSC_EMP.MP_88.0.BROADCAST.INTERVAL: 1000 (Vital Adjustable)
CLASSC_EMP.MP_88.0.TEST.INTERVAL: 0 (Vital Adjustable)
CLASSC_EMP.MP_88.0.RADIO.CONFIG.STRING: 0 (Non-vital Adjustable)
CLASSC_EMP.MP_88.1.Enabled: 1 (Vital Adjustable)
CLASSC_EMP.MP_88.1.Station.Address: 2 (Vital Adjustable)
CLASSC_EMP.MP_88.1.BROADCAST.INTERVAL: 1000 (Vital Adjustable)
CLASSC_EMP.MP_88.1.TEST.INTERVAL: 0 (Vital Adjustable)
CLASSC_EMP.MP_88.1.RADIO.CONFIG.STRING: 0 (Non-vital Adjustable)

GPS_MASTER: GPS Master
GPS_MASTER.Enabled: 1 (Vital Adjustable)
Point.Point: 1 (Vital Adjustable)
Port: 2 (Vital Adjustable)
BAUD: 9600 (Non-vital Adjustable)
StopBits: 1 (Non-vital Adjustable)
Parity: 1 (Non-vital Adjustable)
Key.On.Delay: 0 (Non-vital Adjustable)

Key.Off.Delay: 0 (Non-vital Adjustable)
Master.Timeout: 2000 msec (Non-vital Adjustable)
Polling.Interval: 1000 msec (Non-vital Adjustable)
Stale.Data.Timeout: 300000 (Vital Adjustable)
Link.Timeout: 60000 (Non-vital Adjustable)
Interbyte.Timeout: 0 msec (Non-vital Adjustable)
UTC.Clock.Recovery.Window: 3 (Vital Adjustable)
Dynamics.Code: 4 (Non-vital Adjustable)
Minimum.Signal: 2 (Non-vital Adjustable)
Maximum.PDOP: 8 (Non-vital Adjustable)
Position.Latitude: 0 (Vital Adjustable)
Position.Longitude: 0 (Vital Adjustable)
Position.Altitude: 0 (Vital Adjustable)

*** System Level Configuration Parameters:

ApplicationChecksum: 0 (Vital Adjustable)
ExecutiveChecksum: 0 (Vital Adjustable)
Executive.Version: 0 (Fixed)

Application.Version: 0 (Fixed)
Event.Threshold.1: 1 (Non-vital Adjustable)
Event.Threshold.2: 1 (Non-vital Adjustable)
Event.Threshold.3: 1 (Non-vital Adjustable)
Event.Threshold.4: 1 (Non-vital Adjustable)
Event.Threshold.5: 1 (Non-vital Adjustable)
Event.Threshold.6: 1 (Non-vital Adjustable)
Event.Threshold.7: 1 (Non-vital Adjustable)
Event.Threshold.8: 1 (Non-vital Adjustable)
Event.Threshold.9: 1 (Non-vital Adjustable)
Event.Threshold.10: 1 (Non-vital Adjustable)
Event.Threshold.11: 1 (Non-vital Adjustable)
Event.Threshold.12: 1 (Non-vital Adjustable)
Event.Threshold.13: 1 (Non-vital Adjustable)
Event.Threshold.14: 1 (Non-vital Adjustable)
Event.Threshold.15: 1 (Non-vital Adjustable)
Event.Threshold.16: 1 (Non-vital Adjustable)
Event.Threshold.17: 1 (Non-vital Adjustable)
Event.Threshold.18: 1 (Non-vital Adjustable)
Event.Threshold.19: 1 (Non-vital Adjustable)
Event.Threshold.20: 1 (Non-vital Adjustable)
Event.Threshold.21: 1 (Non-vital Adjustable)
Event.Threshold.22: 1 (Non-vital Adjustable)
Event.Threshold.23: 1 (Non-vital Adjustable)
Event.Threshold.24: 1 (Non-vital Adjustable)
Event.Threshold.25: 1 (Non-vital Adjustable)

Event.Threshold.26: 1 (Non-vital Adjustable)
Event.Threshold.27: 1 (Non-vital Adjustable)
Event.Threshold.28: 1 (Non-vital Adjustable)
Event.Threshold.29: 1 (Non-vital Adjustable)
Event.Threshold.30: 1 (Non-vital Adjustable)
Event.Threshold.31: 1 (Non-vital Adjustable)
Event.Threshold.32: 1 (Non-vital Adjustable)
Event.Threshold.33: 1 (Non-vital Adjustable)
Event.Threshold.34: 1 (Non-vital Adjustable)
Event.Threshold.35: 1 (Non-vital Adjustable)
Event.Threshold.36: 1 (Non-vital Adjustable)
Event.Threshold.37: 1 (Non-vital Adjustable)
Event.Threshold.38: 1 (Non-vital Adjustable)
Event.Threshold.39: 2 (Non-vital Adjustable)
Event.Threshold.40: 1 (Non-vital Adjustable)
Event.Threshold.41: 1 (Non-vital Adjustable)
Event.Threshold.42: 1 (Non-vital Adjustable)
Event.Threshold.43: 1 (Non-vital Adjustable)
Event.Threshold.44: 1 (Non-vital Adjustable)
Event.Threshold.45: 1 (Non-vital Adjustable)
Event.Threshold.46: 1 (Non-vital Adjustable)
Event.Threshold.47: 1 (Non-vital Adjustable)

Event.Threshold.48: 1 (Non-vital Adjustable)
Event.Threshold.49: 1 (Non-vital Adjustable)
Event.Threshold.50: 1 (Non-vital Adjustable)
Event.Threshold.51: 1 (Non-vital Adjustable)
Event.Threshold.52: 1 (Non-vital Adjustable)
Event.Threshold.53: 1 (Non-vital Adjustable)
Event.Threshold.54: 1 (Non-vital Adjustable)
Event.Threshold.55: 1 (Non-vital Adjustable)
Event.Threshold.56: 1 (Non-vital Adjustable)
Event.Threshold.57: 1 (Non-vital Adjustable)
Event.Threshold.58: 1 (Non-vital Adjustable)
Event.Threshold.59: 1 (Non-vital Adjustable)
Event.Threshold.60: 1 (Non-vital Adjustable)
Event.Threshold.61: 1 (Non-vital Adjustable)
Event.Threshold.62: 1 (Non-vital Adjustable)
Event.Threshold.63: 1 (Non-vital Adjustable)
Event.Threshold.64: 1 (Non-vital Adjustable)
Logic.Timeout: 500 (Vital Adjustable)
Configuration.Compatibility: 0 (Fixed)
PC.Vital.Config.Date: 0 (Vital Adjustable)
PC.NV.Config.Date: 0 (Non-vital Adjustable)
Front.Vital.Config.Date: 0 (Vital Adjustable)
Front.NV.Config.Date: 0 (Non-vital Adjustable)
Password: 0 (Vital Adjustable)

Debug.Port.Address: 1 (Fixed)
Debug.Port.Baudrate: 9600 (Fixed)
Delay.Reset: 0 (Fixed)

14.3. GPS.MASTER/MIL.PEER Example Program

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 1

```
 1   /*
 2 //        Object Controller Test Application
 3 // */
 4
 5   OBJECT_CONTROLLER Program GPS.PEER.TEST;
 6
 7   SITE.ID.STRING: "GPS LAB TEST";
 8   DATE.STAMP: "MARCH 4, 2009";
 9
10
11    INTERFACE
12
13      LOCAL
14
15        BOARD: THESCC
16        ADJUSTABLE ENABLE: 1
17        TYPE: SCC
```

```
18
19      BOARD: THEMIXIO
20      ADJUSTABLE ENABLE: 1
21      TYPE: MIXIO
22
23        OUTPUT:  BO.1,  BO.2,  BO.3,  BO.4;
24
25        INPUT:      BI.1,  BI.2,  BI.3,  BI.4;
26                ADJUSTABLE ENABLE: 1;
27
28        NV.ANALOG.INPUT: AI.1;
29                ADJUSTABLE ENABLE: 1;
30                ADJUSTABLE MINIMUM.THRESHOLD: 12.2;  //0.0-30.0
31                ADJUSTABLE MAXIMUM.THRESHOLD: 16.7;  //0.0-30.0
32
33        PROXIMITY.SENSOR.1:
34                ADJUSTABLE ENABLE: 0;
35
36        PROXIMITY.SENSOR.2:
37                ADJUSTABLE ENABLE: 0;
38
39
40
41
42      COMM
```

```
43
44          LINK: GPS_MASTER
45
46          ADJUSTABLE ENABLE: 1
47          PROTOCOL: GPS.MASTER
48          ADJUSTABLE PORT: 2;
```

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 2

```
49          ADJUSTABLE BAUD: 9600;
50          ADJUSTABLE STOPBITS: 1;
51          ADJUSTABLE PARITY: ODD;
52          ADJUSTABLE STALE.DATA.TIMEOUT: 350000:MSEC;
53          ADJUSTABLE LINK.TIMEOUT: 60000:MSEC;
54          ADJUSTABLE MASTER.TIMEOUT: 2000:MSEC;
55          ADJUSTABLE POLLING.INTERVAL: 800:MSEC;
56          ADJUSTABLE UTC.CLOCK.RECOVERY.WINDOW: 4;
57          ADJUSTABLE INTERBYTE.TIMEOUT: 0:MSEC;
58          ADJUSTABLE DYNAMICS.CODE: 4;
59          ADJUSTABLE MINIMUM.SIGNAL: 2.0;
60          ADJUSTABLE MAXIMUM.PDOP: 8.0;
61          ADJUSTABLE POSITION.LATITUDE: 40.43389623281269;
62          ADJUSTABLE POSITION.LONGITUDE: -79.9674354574159;
63          ADJUSTABLE POSITION.ALTITUDE: 201.832884109579;
64          ADJUSTABLE POINT.POINT:   1;
```

```
65
66
67      LINK: MII_PEER1
68
69          ADJUSTABLE ENABLE: 1
70          PROTOCOL: MII.PEER
71          ADJUSTABLE PORT: 1;
72          ADJUSTABLE BAUD: 38400;
73          ADJUSTABLE STOPBITS: 1;
74          ADJUSTABLE PARITY: NONE;
75          ADJUSTABLE KEY.ON.DELAY: 0;
76          ADJUSTABLE KEY.OFF.DELAY: 0;
77          ADJUSTABLE GRANT.DELAY: 10:MSEC;
78          ADJUSTABLE POINT.POINT: 1;
79
80          // VITAL STATION
81          ADJUSTABLE MII.ADDRESS: 270
82
83          ADJUSTABLE ENABLE: 1
84          STATION.NAME: STATION_270;
85          ADJUSTABLE PEER.ADDRESS: 160;
86          ADJUSTABLE TIME.STAMP: 1;
87
88          ADJUSTABLE ACK.TIMEOUT: 1000:MSEC;
89          ADJUSTABLE HEARTBEAT.INTERVAL: 2000:MSEC;
```

```
 90              ADJUSTABLE INDICATION.UPDATE.CYCLE: 2;
 91              ADJUSTABLE STALE.DATA.TIMEOUT: 30000:MSEC;
 92              ADJUSTABLE CLOCK.MASTER: 1;
 93              ADJUSTABLE UTC.TIME.STAMP: 1;
 94
 95              OUTPUT:
 96                      MII.270.160.BO1;
```

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 3

```
 97
 98              INPUT:
 99                      MII.270.160.BI1;
100
101             // VITAL STATION
102             ADJUSTABLE MII.ADDRESS: 10
103
104             ADJUSTABLE ENABLE: 1
105             STATION.NAME: STATION_10;
106             ADJUSTABLE PEER.ADDRESS: 20;
107             ADJUSTABLE TIME.STAMP: 1;
108
109             ADJUSTABLE ACK.TIMEOUT: 1000:MSEC;
110             ADJUSTABLE HEARTBEAT.INTERVAL: 2000:MSEC;
111             ADJUSTABLE INDICATION.UPDATE.CYCLE: 2;
```

```
112             ADJUSTABLE STALE.DATA.TIMEOUT: 30000:MSEC;
113             ADJUSTABLE CLOCK.MASTER: 1;
114             ADJUSTABLE UTC.TIME.STAMP: 0;
115
116             OUTPUT:
117                 MII.10.20.BO1;
118
119             INPUT:
120                 MII.10.20.BI1;
121
122
123
124 BOOLEAN BITS
125     flash1;
126
127 TIMER BITS
128
129     flash1:     SET =   2800:MSEC   CLEAR =     2800:MSEC;
 -1-
130
131
132 CONFIGURATION
133   SYSTEM
134
135     FIXED DEBUG_PORT_ADDRESS:   1;
```

```
136         FIXED DEBUG_PORT_BAUDRATE:   9600;
137         ADJUSTABLE LOGIC_TIMEOUT:    1500:MSEC;
138         APPLICATION.VERSION:         5;
139
140   LOGIC BEGIN
141
142       ASSIGN 1 TO CPS.ENABLE;
 -2-
```

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 4

```
143
144       NV.ASSIGN UTC.CLOCK.VALID TO LED.3;
 -3-
145       NV.ASSIGN UTC.CLOCK.INVALID TO LED.4;
 -4-
146
147       ASSIGN ~flash1 TO flash1;
 -5-
148
149       ASSIGN flash1 TO MII.270.160.BO1;
 -6-
150       ASSIGN ~flash1 TO MII.10.20.BO1;
 -7-
151
```

```
152       NV.ASSIGN MII.270.160.BO1 TO LED.1;
 -8-
153       NV.ASSIGN MII.10.20.BO1 TO LED.2;
 -9-
154
155    END LOGIC
156
157    END PROGRAM
158
```

*** Created on Thu Apr 09 15:27:52 2009

by Object Controller Compiler Version 1.40 (N800302-0001)

*** Application Image Summary:

Target: Object Controller

Application Image CRC: 67e2

Application Image Checksum: c4d9

*** Address Select Jumper Settings:

THESCC: SCC

0 1 2 3 4 5 6 7

1 0 0 0 0 0 0 0

THEMIXIO: MIXIO

0 1 2 3 4 5 6 7

0 1 0 0 0 0 0 0

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 5

*** Unassigned User-Defined Output Bits:

85 BO.1	OUTPUT BIT
86 BO.2	OUTPUT BIT
87 BO.3	OUTPUT BIT
88 BO.4	OUTPUT BIT

*** Unused User-Defined Input Bits:

89 BI.1	INPUT BIT
90 BI.2	INPUT BIT
91 BI.3	INPUT BIT

92 BI.4 INPUT BIT

106 MII.270.160.BI1 INPUT BIT

108 MII.10.20.BI1 INPUT BIT

*** Unused or Unassigned Internal Bits:

None Found

*** Bit Usage Summary:

BIT #	NAME	CONTACT TYPE FRONT	CONTACT TYPE BACK	# TIMES USED AS A TRIGGER BLOCK	TABLE	CODE	ASGNS	TARG	VITALITY
1	RESET	0	0	0	0	0	-	SYSTEM	VITAL OUT
2	QUICK.RESET	0	0	0	0	0	-	SYSTEM	VITAL OUT
3	KILL	0	0	0	0	0	-	SYSTEM	VITAL OUT
4	CPS.ENABLE	0	0	0	0	0	1	SYSTEM	VITAL OUT
5	CPS.STATUS	0	0	0	0	0	-	SYSTEM	VITAL IN
6	USER.RESTRICTED	0	0	0	0	0	-	SYSTEM	VITAL IN
7	ERROR.RESTRICTED								

0 0 0 0 0 - SYSTEM VITAL IN

8 CONFIGURE.ERROR

0 0 0 0 0 - SYSTEM VITAL IN

10 CLOCK.FREEZE

0 0 0 0 0 - SYSTEM VITAL OUT

11 CLOCK.SET 0 0 0 0 0 - SYSTEM VITAL OUT

12 PEER.CLOCK.SET

0 0 0 0 0 - SYSTEM VITAL OUT

14 LOG.OK 0 0 0 0 0 - SYSTEM NON IN

16 LOG.LARGE 0 0 0 0 0 - SYSTEM VITAL IN

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 6

17 LOG.FULL 0 0 0 0 0 - SYSTEM VITAL IN

50 LED.1 0 0 0 0 0 1 SYSTEM NON OUT

51 LED.2 0 0 0 0 0 1 SYSTEM NON OUT

52 LED.3 0 0 0 0 0 1 SYSTEM NON OUT

53 LED.4 0 0 0 0 0 1 SYSTEM NON OUT

60 CPS.RESET 0 0 0 0 0 - SYSTEM VITAL OUT

61 UTC.CLOCK.INVALID

1 0 0 0 0 - SYSTEM VITAL OUT

62 UTC.CLOCK.VALID

1 0 0 0 0 - SYSTEM VITAL OUT

65 THESCC.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

66 THESCC.Selective.Shutdown

0 0 0 0 0 - SYSTEM VITAL IN

67 THESCC.Spare.1

0 0 0 0 0 - SYSTEM VITAL IN

68 THESCC.Spare.2

0 0 0 0 0 - SYSTEM VITAL IN

69 THEMIXIO.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

70 THEMIXIO.Selective.Shutdown

0 0 0 0 0 - SYSTEM VITAL IN

71 THEMIXIO.Spare.1

0 0 0 0 0 - SYSTEM VITAL IN

72 THEMIXIO.Spare.2

0 0 0 0 0 - SYSTEM VITAL IN

73 THEMIXIO.Spare.3

0 0 0 0 0 - SYSTEM VITAL IN

74 THEMIXIO.Input.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

75 THEMIXIO.Error

0 0 0 0 0 - SYSTEM VITAL IN

76 THEMIXIO.NV.Analog.Input.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

77 THEMIXIO.NV.Analog.Input.Valid

0 0 0 0 0 - SYSTEM NON IN

78 THEMIXIO.NV.Analog.Input.LED

0 0 0 0 0 - SYSTEM NON OUT

79 THEMIXIO.Proximity.Sensor.1

0 0 0 0 0 - SYSTEM VITAL IN

80 THEMIXIO.Proximity.Sensor.1.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

81 THEMIXIO.Proximity.Sensor.1.Indeterminate

0 0 0 0 0 - SYSTEM VITAL IN

82 THEMIXIO.Proximity.Sensor.2

0 0 0 0 0 - SYSTEM VITAL IN

83 THEMIXIO.Proximity.Sensor.2.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 7

84 THEMIXIO.Proximity.Sensor.2.Indeterminate

0 0 0 0 0 - SYSTEM VITAL IN

85 BO.1 0 0 0 0 0 - - VITAL OUT

86 BO.2 0 0 0 0 0 - - VITAL OUT

87 BO.3 0 0 0 0 0 - - VITAL OUT

88 BO.4 0 0 0 0 0 - - VITAL OUT

89 BI.1 0 0 0 0 0 - - VITAL IN

90 BI.2 0 0 0 0 0 - - VITAL IN

91 BI.3 0 0 0 0 0 - - VITAL IN

92 BI.4 0 0 0 0 0 - - VITAL IN

93 GPS_MASTER.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

94 GPS_MASTER.Disable

0 0 0 0 0 - SYSTEM VITAL OUT

95 MII_PEER1.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

96 MII_PEER1.Disable

0 0 0 0 0 - SYSTEM VITAL OUT

97 MII_PEER1.STATION_270.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

98 MII_PEER1.STATION_270.Status

0 0 0 0 0 - SYSTEM VITAL IN

99 MII_PEER1.STATION_270.Inputs.Received

0 0 0 0 0 - SYSTEM VITAL IN

100 MII_PEER1.STATION_270.Disable

0 0 0 0 0 - SYSTEM VITAL OUT

101 MII_PEER1.STATION_10.Enabled

0 0 0 0 0 - SYSTEM VITAL IN

102 MII_PEER1.STATION_10.Status

0 0 0 0 0 - SYSTEM VITAL IN

103 MII_PEER1.STATION_10.Inputs.Received

0 0 0 0 0 - SYSTEM VITAL IN

104 MII_PEER1.STATION_10.Disable

0 0 0 0 0 - SYSTEM VITAL OUT

105 MII.270.160.BO1

1 0 0 0 0 1 ASGN VITAL OUT

106 MII.270.160.BI1

0 0 0 0 0 - - VITAL IN

107 MII.10.20.BO1

1 0 0 0 0 1 ASGN VITAL OUT

108 MII.10.20.BI1

0 0 0 0 0 - - VITAL IN

109 flash1 1 2 0 0 0 1 ASGN VITAL INT

*** Numeric Usage Summary:

NAME MINIMUM MAXIMUM ERROR INITIAL EVAL TARGET VITAL

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 8

110 CLOCK.MONTH -2147483648 2147483647 0 0 - SYSTEM VITAL OUT

111 CLOCK.DAY -2147483648 2147483647 0 0 - SYSTEM VITAL OUT

112 CLOCK.YEAR -2147483648 2147483647 0 0 - SYSTEM VITAL OUT

113 CLOCK.HOUR -2147483648 2147483647 0 0 - SYSTEM VITAL OUT

114 CLOCK.MINUTE -2147483648 2147483647 0 0 - SYSTEM VITAL OUT

115 CLOCK.SECOND -2147483648 2147483647 0 0 - SYSTEM VITAL OUT

116 APP.CRC -2147483648 2147483647 0 0 - SYSTEM VITAL IN

117 APP.VERSION -2147483648 2147483647 0 0 - SYSTEM VITAL IN

118 EXEC.CRC -2147483648 2147483647 0 0 - SYSTEM VITAL IN

119 SYSTEM.LOAD -2147483648 2147483647 0 0 - SYSTEM VITAL IN

120 CONFIG.CRC -2147483648 2147483647 0 0 - SYSTEM VITAL IN

121 NUMERIC.SPARE.1 -2147483648 2147483647 0 0 - SYSTEM VITAL IN

122 NUMERIC.SPARE.2 -2147483648 2147483647 0 0 - SYSTEM VITAL IN

123 AI.1 -2147483648 2147483647 0 0 - - NON IN

*** Board Summary:

THESCC: SCC

THESCC.Enabled: 1 (Vital Adjustable)

THESCC.Selective.Shutdown: 0 (Fixed)

THEMIXIO: MIXIO

THEMIXIO.Enabled: 1 (Vital Adjustable)

THEMIXIO.Selective.Shutdown: 0 (Fixed)

THEMIXIO.Input.Enabled: 1 (Vital Adjustable)

THEMIXIO.NV.Analog.Input.Enabled: 1 (Vital Adjustable)

THEMIXIO.Minimum.Threshold: 122 (Non-vital Adjustable)

THEMIXIO.Maximum.Threshold: 167 (Non-vital Adjustable)

THEMIXIO.Proximity.Sensor.1.Enabled: 0 (Vital Adjustable)

THEMIXIO.Proximity.Sensor.2.Enabled: 0 (Vital Adjustable)

*** Link Summary:

GPS_MASTER: GPS Master

GPS_MASTER.Enabled: 1 (Vital Adjustable)

Point.Point: 1 (Vital Adjustable)

Port: 2 (Vital Adjustable)

BAUD: 9600 (Non-vital Adjustable)

StopBits: 1 (Non-vital Adjustable)

Parity: 1 (Non-vital Adjustable)

Key.On.Delay: 0 (Non-vital Adjustable)

Key.Off.Delay: 0 (Non-vital Adjustable)

Master.Timeout: 2000 msec (Non-vital Adjustable)

Polling.Interval: 800 msec (Non-vital Adjustable)

Stale.Data.Timeout: 350000 (Vital Adjustable)

Link.Timeout: 60000 (Non-vital Adjustable)

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 9

Interbyte.Timeout: 0 msec (Non-vital Adjustable)

UTC.Clock.Recovery.Window: 4 (Vital Adjustable)

Dynamics.Code: 4 (Non-vital Adjustable)

Minimum.Signal: 2 (Non-vital Adjustable)

Maximum.PDOP: 8 (Non-vital Adjustable)

Position.Latitude: 0 (Vital Adjustable)

Position.Longitude: 0 (Vital Adjustable)

Position.Altitude: 0 (Vital Adjustable)

MII_PEER1: MII Peer

MII_PEER1.Enabled: 1 (Vital Adjustable)

Point.Point: 1 (Vital Adjustable)

Port: 1 (Vital Adjustable)

BAUD: 38400 (Non-vital Adjustable)

StopBits: 1 (Non-vital Adjustable)

Parity: 0 (Non-vital Adjustable)

Key.On.Delay: 0 (Non-vital Adjustable)

Key.Off.Delay: 0 (Non-vital Adjustable)

Debug.Port.Address.Type: 0 (Fixed)

Debug.Port.Address: 0x0 (Fixed)

Grant.Delay: 10 (Non-vital Adjustable)

MII_PEER1.STATION_270.Enabled: 1 (Vital Adjustable)

MII_PEER1.STATION_270.TIME.STAMP: 1 (Vital Adjustable)

MII_PEER1.STATION_270.Station.Address.Type: 1 (Fixed)

MII_PEER1.STATION_270.Station.Address: 17694720 (Vital Adjustable)

MII_PEER1.STATION_270.PEER.ADDRESS: 0 (Vital Adjustable)

MII_PEER1.STATION_270.Stale.Data.Timeout: 30000 (Vital Adjustable)

MII_PEER1.STATION_270.ACK.TIMEOUT: 1000 (Vital Adjustable)

MII_PEER1.STATION_270.HEARTBEAT.INTERVAL: 2000 (Vital Adjustable)

MII_PEER1.STATION_270.INDICATION.UPDATE.CYCLE: 2 (Vital Adjustable)

MII_PEER1.STATION_270.CLOCK.MASTER: 1 (Vital Adjustable)

MII_PEER1.STATION_270.UTC.TIME.STAMP: 1 (Vital Adjustable)

MII_PEER1.STATION_10.Enabled: 1 (Vital Adjustable)

MII_PEER1.STATION_10.TIME.STAMP: 1 (Vital Adjustable)

MII_PEER1.STATION_10.Station.Address.Type: 1 (Fixed)

MII_PEER1.STATION_10.Station.Address: 655360 (Vital Adjustable)

MII_PEER1.STATION_10.PEER.ADDRESS: 0 (Vital Adjustable)

MII_PEER1.STATION_10.Stale.Data.Timeout: 30000 (Vital Adjustable)

MII_PEER1.STATION_10.ACK.TIMEOUT: 1000 (Vital Adjustable)

MII_PEER1.STATION_10.HEARTBEAT.INTERVAL: 2000 (Vital Adjustable)

MII_PEER1.STATION_10.INDICATION.UPDATE.CYCLE: 2 (Vital Adjustable)

MII_PEER1.STATION_10.CLOCK.MASTER: 1 (Vital Adjustable)

MII_PEER1.STATION_10.UTC.TIME.STAMP: 0 (Vital Adjustable)

*** System Level Configuration Parameters:

ApplicationChecksum: 0 (Vital Adjustable)

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 10

ExecutiveChecksum: 0 (Vital Adjustable)

Executive.Version: 0 (Fixed)

Application.Version: 5 (Fixed)

Event.Threshold.1: 1 (Non-vital Adjustable)

Event.Threshold.2: 1 (Non-vital Adjustable)

Event.Threshold.3: 1 (Non-vital Adjustable)

Event.Threshold.4: 1 (Non-vital Adjustable)

Event.Threshold.5: 1 (Non-vital Adjustable)

Event.Threshold.6: 1 (Non-vital Adjustable)

Event.Threshold.7: 1 (Non-vital Adjustable)

Event.Threshold.8: 1 (Non-vital Adjustable)

Event.Threshold.9: 1 (Non-vital Adjustable)

Event.Threshold.10: 1 (Non-vital Adjustable)

Event.Threshold.11: 1 (Non-vital Adjustable)

Event.Threshold.12: 1 (Non-vital Adjustable)

Event.Threshold.13: 1 (Non-vital Adjustable)

Event.Threshold.14: 1 (Non-vital Adjustable)

Event.Threshold.15: 1 (Non-vital Adjustable)

Event.Threshold.16: 1 (Non-vital Adjustable)

Event.Threshold.17: 1 (Non-vital Adjustable)

Event.Threshold.18: 1 (Non-vital Adjustable)

Event.Threshold.19: 1 (Non-vital Adjustable)

Event.Threshold.20: 1 (Non-vital Adjustable)

Event.Threshold.21: 1 (Non-vital Adjustable)

Event.Threshold.22: 1 (Non-vital Adjustable)

Event.Threshold.23: 1 (Non-vital Adjustable)

Event.Threshold.24: 1 (Non-vital Adjustable)

Event.Threshold.25: 1 (Non-vital Adjustable)

Event.Threshold.26: 1 (Non-vital Adjustable)

Event.Threshold.27: 1 (Non-vital Adjustable)

Event.Threshold.28: 1 (Non-vital Adjustable)

Event.Threshold.29: 1 (Non-vital Adjustable)

Event.Threshold.30: 1 (Non-vital Adjustable)

Event.Threshold.31: 1 (Non-vital Adjustable)

Event.Threshold.32: 1 (Non-vital Adjustable)

Event.Threshold.33: 1 (Non-vital Adjustable)

Event.Threshold.34: 1 (Non-vital Adjustable)

Event.Threshold.35: 1 (Non-vital Adjustable)

Event.Threshold.36: 1 (Non-vital Adjustable)

Event.Threshold.37: 1 (Non-vital Adjustable)

Event.Threshold.38: 1 (Non-vital Adjustable)

Event.Threshold.39: 1 (Non-vital Adjustable)

Event.Threshold.40: 1 (Non-vital Adjustable)

Event.Threshold.41: 1 (Non-vital Adjustable)

Event.Threshold.42: 1 (Non-vital Adjustable)

Event.Threshold.43: 1 (Non-vital Adjustable)

Event.Threshold.44: 1 (Non-vital Adjustable)

Event.Threshold.45: 1 (Non-vital Adjustable)

Application: GPS.PEER.TEST compiled on Thu Apr 09 15:27:52 2009

CRC = 67e2 Checksum = c4d9 Page: 11

Event.Threshold.46: 1 (Non-vital Adjustable)

Event.Threshold.47: 1 (Non-vital Adjustable)

Event.Threshold.48: 1 (Non-vital Adjustable)

Event.Threshold.49: 1 (Non-vital Adjustable)

Event.Threshold.50: 1 (Non-vital Adjustable)

Event.Threshold.51: 1 (Non-vital Adjustable)

Event.Threshold.52: 1 (Non-vital Adjustable)

Event.Threshold.53: 1 (Non-vital Adjustable)

Event.Threshold.54: 1 (Non-vital Adjustable)

Event.Threshold.55: 1 (Non-vital Adjustable)

Event.Threshold.56: 1 (Non-vital Adjustable)

Event.Threshold.57: 1 (Non-vital Adjustable)

Event.Threshold.58: 1 (Non-vital Adjustable)

Event.Threshold.59: 1 (Non-vital Adjustable)

Event.Threshold.60: 1 (Non-vital Adjustable)

Event.Threshold.61: 1 (Non-vital Adjustable)

Event.Threshold.62: 1 (Non-vital Adjustable)

Event.Threshold.63: 1 (Non-vital Adjustable)

Event.Threshold.64: 1 (Non-vital Adjustable)

Logic.Timeout: 1500 (Vital Adjustable)

Configuration.Compatibility: 0 (Fixed)

PC.Vital.Config.Date: 0 (Vital Adjustable)

PC.NV.Config.Date: 0 (Non-vital Adjustable)

Front.Vital.Config.Date: 0 (Vital Adjustable)

Front.NV.Config.Date: 0 (Non-vital Adjustable)

Password: 0 (Vital Adjustable)

Debug.Port.Address: 1 (Fixed)

Debug.Port.Baudrate: 9600 (Fixed)

Delay.Reset: 0 (Fixed)

15. EXAMINING AN APPLICATION PROGRAM

NOTE

The user MUST be familiar with the MICROLOK II syntax contained in the MICROLOK II set of Service Manuals (SM 6800). This section covers the differences between the OC and the standard MICROLOK II system.

15.1. Scope of Section

This section will review a typical MICROLOK Object Controller application structure.

NOTE

The OC is a vital system and is designed as a safety-critical system.

The section is comprised of these topics:

- Application Programming – Getting Started
- The Interface Section
- Data Definitions: Boolean Bits
- Timing Attributes
- Constant Definitions
- The Unit Configuration Section
- The Logic Begin Section
- Program Processing Order

15.1.1. Reference Material

SM-6800D, the "MICROLOK II System Application Logic Programming Guide" published by ASTS USA.

SM-6800K, "MICROLOK II Network Protocol and Networking Hardware" published by ASTS USA.

```
 [OBJECT_CONTROLLER] PROGRAM <name>;
INTERFACE
        <interface definitions>
[BOOLEAN BITS <bit list>;]
[NV.BOOLEAN BITS <bit list>;]
[NUMERIC VARIABLES <variable list>;]
[NV.NUMERIC VARIABLES <variable list>;]
[ATTRIBUTES
        <numeric attribute lists>]
[TIMER BITS
        <Timer Bit Lists>]
[CODED OUTPUTS
        <Toggle Statements>]
[LOG
        <Items to log>]
[CONSTANTS
        <Constant definitions>]
[ARRAYS
        <Array definitions>]
[CONFIGURATION
        <Configurations>]
LOGIC BEGIN
        <Boolean statements>
END LOGIC
[TABLES BEGIN
        <Table definitions>
END TABLES]
[NUMERIC BEGIN
        <Numeric blocks>
END NUMERIC]
END PROGRAM
```

Figure 15-1. Typical Object Controller Application High-Level Format

15.2. Reviewing a MICROLOK Object Controller Program's Structure

Refer to Section 3.2, "Program Structure," in SM-6800D.

Refer to the sample application in Section 15.2.

15.2.1. Program Title

Refer to Section 3.4, "Program Title," in SM-6800D.

Every OC program must begin with the title block and <name>.

An example of a program title:

```
OBJECT_CONTROLLER PROGRAM <name>;
```

15.2.2. Interface Section Overview

Refer to Section 3.5, "Interface Section," in SM-6800D.

Example of a program's interface section:

```
INTERFACE
 [LOCAL
    <Local I/O Definitions>]
 [COMM
    <Link Definitions>]
```

15.2.3. Local I/O Definition

The OC unit imposes a physical limit of two I/O boards maximum, plus an SCC board. The application can define at most three I/O boards. Thus, no more than three I/O boards could be enabled in any single configuration.

Different types of I/O boards are placed in different address spaces, or address classes. There is a limit of two I/O boards that can be defined in any address class except for the SCC board – only one can be defined and it must be defined first, and the LED6 board – only one board can be defined because of physical limitations to the package size. The compiler assigns addresses by class in the order of definition of the board. The relationship between board type and address class is listed in Table 16-1.

Valid Peripheral Address (VPA)

For every I/O board defined, the compiler creates two bits based on the board's name. These are:

<board name>.ENABLED (Read only)

<board name>.SELECTIVE.SHUTDOWN

The **<board name>** . ENABLED bit indicates to the application if board has been enabled in the configuration. The **<board name>**.SELECTIVE.SHUTDOWN bit is not supported at this time.

Table 15-1. PCB Board Type

BOARD TYPE
SCC
MIX I/O
IN6.OUT6
IN6
LED6

15.2.4. The Interface Section – LOCAL Sub-Section

15.2.4.1. Defining Board Type SCC

Example board definition:

Address Class: 16 Bit VPA
A definition of this type of board looks like:

BOARD: <USER NAME>

[ADJUSTABLE|FIXED] ENABLE:<FLAG>

TYPE: SCC

Notes:

- There are no inputs or outputs associated with this board.
- Every application must contain an SCC board and it must be defined first in the LOCAL sub-section.

Example Board Definition:

BOARD: The SCC

ADJUSTABLE ENABLE: 1

TYPE: SCC

15.2.4.2. Defining Board Type MIX I/O

Example board definition:

Address Class: 16 Bit VPA
A definition of this type of board looks like:

```
BOARD: <USER NAME>
            [ADJUSTABLE|FIXED] ENABLE:<FLAG>
TYPE: MIXIO

[

      [OUTPUT: <bit list>;              (1-4 Output bits)]
      [INPUT: <bit list>;               (1-4 Input bits)]

]

[

      NV.ANALOG.INPUT: <numeric variable>;
      [ADJUSTABLE|FIXED] ENABLE:<FLAG>;
      [ADJUSTABLE|FIXED] MINIMUM THRESHOLD VALUE:<NUMERIC VALUE>;
(0.0-30.0 Volts)

      [ADJUSTABLE|FIXED] MAXIMUM THRESHOLD VALUE:<NUMERIC VALUE>;
(0.0-30.0 Volts)

]

[

      PROXIMITY.SENSOR.1:
      [ADJUSTABLE|FIXED] ENABLE:<FLAG>;

      PROXIMITY.SENSOR.2:
      [ADJUSTABLE|FIXED] ENABLE:<FLAG>;

]
```

Additional compiler defined bits:

```
<board name>.Proximity.Sensor.1                    (Read only)

<board name>.Proximity.Sensor.1.Enabled            (Read only)

<board name>.Proximity.Sensor.1.Indeterminate      (Read only)
```

<board name>.Proximity.Sensor.2 (Read only)

<board name>.Proximity.Sensor.2.Enabled (Read only)

<board name>.Proximity.Sensor.2.Indeterminate (Read only)

Notes:

- Threshold levels for the analog inputs are defined in tenths of a volt and range is defined from 0.0 to 30.0 volts.
- **<board name>.Proximity.Sensor.x** states whether the Proximity Sensor is Set (Touching) or Clear (Not Touching).
- If the **<board name>.Proximity.Sensor.x.Indeterminate** is set, this states that the Proximity Sensor is in an invalid state and the **<board name>.Proximity.Sensor.x** bit should be clear.
- Target indication for any vital Object Controller application shall always be based on the current status of **two** proximity sensors inputs.
- For vital applications, it is recommended that the application should be written so that a mismatch of stable paired proximity sensor inputs (i.e., one sensor input indicating and one sensor not indicating) results in the application logic interpreting the instability as a failure of one or more of the connected sensors. In this event the application logic will latch the condition to ensure a maintenance person is required to physically inspect the device(s) and make the needed repairs before normal operation is restored.

Example Board Definition:

```
BOARD: THEMIXIO

ADJUSTABLE ENABLE: 0

TYPE: MIXIO

   OUTPUT: BO.1,  BO.2,  BO.3,  BO.4;

   INPUT:    BI.1,  BI.2,  BI.3,  BI.4;

         ADJUSTABLE ENABLE: 1;


   NV.ANALOG.INPUT: AI.1;

         ADJUSTABLE ENABLE: 1;
```

ADJUSTABLE MINIMUM.THRESHOLD: 10.0;

ADJUSTABLE MAXIMUM.THRESHOLD: 16.0;

PROXIMITY.SENSOR.1:

ADJUSTABLE ENABLE: 1;

PROXIMITY.SENSOR.2:

ADJUSTABLE ENABLE: 1;

15.2.4.3. Defining Board Type IN6.OUT6

Address Class: 16 Bit VPA

A definition of this type of board looks like:

BOARD: <USER NAME>

[ADJUSTABLE|FIXED] ENABLE:<FLAG>

TYPE: IN6.OUT6

[OUTPUT: <bit list>;] (1-6 Outputs)

[INPUT:<bit list>;] (1-6 Inputs)

[ADJUSTABLE|FIXED] ENABLE:<FLAG>;

Example Board Definition:

BOARD: THEIN6OUT6

ADJUSTABLE ENABLE: 0

TYPE: IN6.OUT6

OUTPUT: OUT.1, OUT.2, OUT.3, OUT.4, OUT.5, OUT.6;

INPUT: IN.1, IN.2, IN.3, IN.4, IN.5, IN.6;

ADJUSTABLE ENABLE: 1;

15.2.4.4. Defining Board Type IN6

Address Class: 16 Bit VPA
A definition of this type of board looks like:

BOARD: <USER NAME>

[ADJUSTABLE|FIXED] ENABLE:<FLAG>

TYPE: IN6

[INPUT:<bit list>;] (1-6 Inputs)

Example Board Definition:

BOARD: THEIN6

ADJUSTABLE ENABLE: 0

TYPE: IN6

INPUT: IN.1, IN.2, IN.3, IN.4, IN.5, IN.6;

15.2.4.5. Defining Board Type LED6

Example board definition:

Address Class: 16 Bit VPA
A definition of this type of board looks like:

BOARD: <USER NAME>

[ADJUSTABLE|FIXED] ENABLE:<FLAG>

TYPE: LED6

[OUTPUT: <bit list>;] (1-6 Outputs)

[SIGNAL.GOOD: <bit list>;] (1-6 Inputs)

[NV.OUTPUT: <bit name>;] (1 Output)

[NV.INPUT: <bit name>;] (1 Input)

[ADJUSTABLE|FIXED] ENABLE:<FLAG>;

Additional compiler defined bits:

<board name>.RETEST.LEDS (Read/Write)

Notes:

- **NV.INPUT:**

The LED6 PCB has a non-vital input that can be used like any standard MICROLOK II non-vital input. This input is included to provide the application designer an easy method to implement <board name>.RETEST.LEDS, but it can be used for any non-vital purpose the designer chooses. An example of using the input to implement <board name>.RETEST.LEDS is presented in Section 13.2.

- **SIGNAL.GOOD:**

The polarity of the SIGNAL.GOOD system bit is SET when the OC diagnostics determine the signal to be working properly, and CLEAR when they determine the signal to be faulty. This is the opposite of the polarity for the LAMP.OUT system bit used for LAMP16 signals.

WARNING

Application logic should be written to always examine the SIGNAL.GOOD system bit and to turn OFF a signal that has been detected by the OC diagnostics to be faulty. Failure to do so may result in a signal that could appear as partially illuminated or intermittent which could cause problems.

This is similar to the way the LAMP.OUT system bit must be used for lamps driven by the MICROLOK II LAMP16 board. Refer to ASTS USA Service Manual SM-6800D, Appendix B.

RETEST.LEDS:

Setting this application bit (1) will clear the fault status and set the .SIGNAL.GOOD bits for all signals connected to the LED6 board. Retesting of the signals will commence immediately and in 1 second the fault status of all signals, and their .SIGNAL.GOOD bits, will be updated. The RETEST.LEDS system bit has a slow pick of 3 seconds, is edge triggered, and has a slow drop of 10 seconds. The application bit must be set (1) for 3 seconds before the application will process the system bit. The RETEST.LEDS must be cleared (0) before the application will recognize another set (1). After the RETEST.LEDS system bit is set (1), no transitions of the bit will be processed for 10 seconds. This prevents logic from repeatedly clearing the fault status.

Flashing:

To overcome the long turn-on time of an incandescent lamp, application programs frequently flashed the signal with a 60/40 duty cycle (60% of the time on, 40% off) resulting in the signal appearing to be 50% on and 50% off. Because the LED Signals turn on and off almost instantaneously, a 50/50 duty cycle will provide the 50/50 visible flashing.

Example Board Definition:

```
BOARD: THELED6
ADJUSTABLE ENABLE: 1
TYPE: LED6
   OUTPUT:
      SIGNAL.OUTPUT.1, SIGNAL.OUTPUT.2,
      SIGNAL.OUTPUT.3, SIGNAL.OUTPUT.4,
      SIGNAL.OUTPUT.5, SIGNAL.OUTPUT.6;

   SIGNAL.GOOD:
      SIGNAL.GOOD.1, SIGNAL.GOOD.2,
      SIGNAL.GOOD.3, SIGNAL.GOOD.4,
      SIGNAL.GOOD.5, SIGNAL.GOOD.6;
```

```
    NV.OUTPUT: NV.OUT.1;
    NV.INPUT: NV.IN.1;
ADJUSTABLE ENABLE: 1;
```

15.2.5. The Interface Section – COMM Sub-Section

CAUTION

When setting the BAUD for the Application Ports, or DEBUG_PORT_BAUDRATE for the Web Tool port, be sure to also adjust the BIT_RATE in the Network Interface configuration (niacfg.ini) file for that port.

15.2.5.1. Communication Link Definition Section

Refer to Section 3.5.2, "Communication Link Definition Section," in SM-6800D and to Section 4.1, "Application Logic Changes - Network Protocol," in SM-6800K.

Note these general points:

- The OC supports serial communication links.
- The user may define up to two serial communication links.
- The serial communication links must be configured so that POINT.POINT is set to 1.
- The COMM declaration heads the Communication Section of the OC application program.
- The MICROLOK PEER Protocol Station definition now contains the UTC.TIME.STAMP option. It can be enabled (1) or disabled(0) just as the TIME.STAMP option is. This option is used to transmit UTC Clock Initialization parameters (Stale Data Time Out and Recovery Window) and the UTC Time-Stamp data to a unit that is connected to a Class C EMP data radio, and to allow the unit's UTC Clock to have the correct time. Only Object Controller Units that utilize the GPS Master Communication Protocol should enable the UTC.TIME.STAMP option. The UTC Time-Stamp data will only be included in Vital messages, Non-Vital Stations will not have this data present in their messages. For an example refer to the Example Application Program and Listing File.

15.2.6. Timing Attributes

Refer to Section 3.8, "Timing Attributes," in SM 6800D.

Note the following information about timing attributes:

- Adjustable timers are not supported.
- Timing characteristics such as a slow-pick and/or a slow drop delay are added to previously defined Boolean bits in the "Timer Bits" section.

- These characteristics can be added to any bit defined in the "Boolean Bits" section or any output bit. They may not be added to any system bit or input bit.
- Because of shared timing resources, there is a combined limit of 399 timers, tables, and numeric blocks that may be defined.

The section to define them consists of one or more Timer Bit Lists. Note this example:

```
TIMER BITS
<Timer Bit Lists>
```

15.2.6.1. Timer Bit Lists

Refer to Section 3.8.1, "Timer Bit Lists," in SM-6800D.

Note the following information about timer bit lists:

- A Timer Bit List is a <bit list> with at least one bit followed by the timing characteristics for those bits.
- Timing characteristics are SET or CLEAR times specified as a value with units. Note this example:

```
<bit list>:SET=<time value>:<unit>CLEAR=<time value>:<unit>;
```

The SET and CLEAR portions must be included and can specify zero values for times. Valid ranges for <time value> depend on the associated <unit>. Refer to Table 15-2.

Table 15-2. Timer Bit Ranges

<UNIT>	VALID <TIME VALUE> VALUES	
MSEC (milliseconds)	0 or 500, up to 6553500	in 100 millisecond increments
SEC (seconds)	0 - 6553	in 1 second increments
MIN (minutes)	0 – 109	in 1 minute increments

If the FIXED qualifier or no qualifier is present before a Timer Bit List, those timers cannot be changed during a configuration session.

15.2.7. System Bits

Several bits are predefined by the compiler to indicate executive status information to the application and to allow the application to control some executive functions. Most of the System Bits that are supported by the MICROLOK II Executive Software are also supported by the OC

Executive Software, please refer to SM-6800D and SM-6800K for a complete list of System Bits that are supported by MICROLOK II.

There are a few System Bits that are not supported by the OC Executive Software because these features are not available to the OC. Please refer to for a list of system bits that are not supported by the OC.

NOTE

There are only four LED.n System Bits, which are used for Non-Vital Outputs that are displayed on the front of the OC, whereas MICROLOK II supports eight LED.n System Bits.

15.2.8. Unit Configuration Section

Refer to Section 3.13, "Unit Configuration," in SM-6800D.

Note the following information about the Configuration Section:

The Configuration Section specifies various system parameters, such as system logging level, debug port address, and user-defined items.

Refer to the sample Configuration Section that follows:

```
CONFIGURATION
[SYSTEM
<Configuration Items>]
```

The SYSTEM sub-sections specify system configuration options.

User configurable bits and user configurable numerics are not used in the OC.

Table 15-3. Compiler Defined System Bits

SYSTEM BIT NAME	BIT FUNCTION	REASON FOR NO SUPPORT
AUXn.INPUT	Non-Vital inputs set from Front Panel. The value of n is between 1 and 32.	Unlike the MICROLOK II CPU Board, the OC CPU Board does not have a front panel with toggle switches.
LAMP.RESET.OPTION	Lamp boards diagnostic mode has been overridden by Front Panel and is in effect.	Unlike the MICROLOK II CPU Board, the OC CPU Board does not have a front panel with toggle switches. The OC does not support the LAMP16 board that is available to MICROLOK II.
PCMCIA.INSTALLED	PCMCIA memory card is installed.	Currently, there is no card reader on the OC that can be used for the User Data Log to be stored externally.
BATTERY.HEALTH	PCMCIA memory card battery is OK if set.	Currently, there is no card reader on the OC that can be used for the User Data Log to be stored externally.
ALARM.1	Sound Onboard Audible Alarm at 2400 Hz when set.	There is no alarm available on the OC.
ALARM.2	Sound Onboard Audible Alarm at 1200 Hz when set.	There is no alarm available on the OC.

16. ERROR CODES

The error codes in Table 16-1 will appear on the Network Diagnostic Tool display if there is a problem. The event recorder will log in the event and display it on the tool when it is called.

NOTE

Fields and bits in the Error Code shown in Table 16-1 as a "?" indicate fields/bits that that are meaningless to the error. These fields/bits have no bearing on the error and can be any value.

Table 16-1. Error Codes

ERROR MESSAGE†	ACTUAL ERROR CODE*			
Unknown Object Controller Mix I/O $t - Code: $W0x $W2x $W4x $W6x	2201			
Object Controller - Mixed I/O Board $B6b - Echo Error $t Expected Echo: $W2x, Actual Echo: $W4x	2201			??01
Object Controller - Mixed I/O Board $B6b - Echo Error	2201			??11
Object Controller - Mixed I/O Board $B6b - Echo Error $t Expected Echo: $W2x, Actual Echo: $W4x	2201			??02
Object Controller - Mixed I/O Board $B6b - Echo Error	2201			??22
Object Controller - Mixed I/O Board $B2b - Type Error	2202		001F	
Object Controller - Mixed I/O Board $B2b, Proximity Sensor 1 in an indeterminate state	2203	???1		0101
Object Controller - Mixed I/O Board $B2b, Proximity Sensor 2 in an indeterminate state	2203	???2		0101
Object Controller - Mixed I/O Board $B2b, Proximity Sensor 1 in a known good state	2203	???3		0101
Object Controller - Mixed I/O Board $B2b, Proximity Sensor 2 in a known good state	2203	???4		0101
Object Controller - Mixed I/O Board $B3b, Bad read for the Proximity Sensor Bypass Circuitry	2203	12??	9FB4	
Object Controller - Mixed I/O Board $B2b, Input $B3d - Input Bad	2203		0000	0100
Object Controller - Mixed I/O Board $B2b, Input $B3d - Input Unstable	2203		0000	0200
Object Controller - Mixed I/O Board $B2b, Input $B3d - Input Good	2203		0000	0400
Object Controller - Mixed I/O Board $B2b, Input $B3d - Input Noisy	2203		0001	0300
Object Controller - Mixed I/O Board $B2b, Output $B3d - Output Flip Failure During Diagnostic Test	2204		0000	0100
Object Controller - Mixed I/O Board $B2b, Output $B3d - Output Failure During Verification	2204		0000	0200
Object Controller - Mixed I/O Board $B2b, Output $B3d - Output Noisy During Diagnostic Test	2204		0001	0300
Object Controller - Mixed I/O Board $B2b, Monitor $B3d - Output Voltage Reference ON Test Noisy	2204		0002	0300
Object Controller - Mixed I/O Board $B2b, Output $B3d - Output Noisy During Verification	2204		0003	0300
Object Controller - Mixed I/O Board $B2b, Monitor $B3d - Output Voltage Reference OFF Test Failure	2205		0000	0100
Object Controller - Mixed I/O Board $B2b, Monitor $B3d - Output Voltage Reference ON Test Failure	2205		0000	0200
Object Controller - Mixed I/O Board $B2b, Monitor $B3d - Output Voltage Reference OFF Test Noisy	2205		0001	0300
Object Controller - Mixed I/O Board $B2b - Invalid Proximity Sensor Diagnostic State	2206	??01		2000

ERROR MESSAGE†	ACTUAL ERROR CODE*			
Object Controller - Mixed I/O Board $B2b - Invalid Proximity Sensor Diagnostic Test	2206	??02		2000
Object Controller - Mixed I/O Board $B6b - Invalid Analog database start value	2206	02??		??01
Object Controller - Mixed I/O Board $B3b - Invalid Proximity Sensor Diagnostic Test selected	2206	03??		
Object Controller - Mixed I/O Board $B3b - Invalid read data for Proximity Sensor database values	2206	05??		
Object Controller - Mixed I/O Board $B7b - Invalid read data for Proximity Sensor valid range values	2206	0500	0101	
Object Controller - Mixed I/O Board $B2b - Invalid Echo check	2206			0100
Object Controller - Mixed I/O Board $B2b - Output compare Failure	2206			04??
Object Controller - Mixed I/O Board $B2b - Proximity Sensor data compare Failure	2206		0400	0000
Object Controller - Mixed I/O Board $B2b - Proximity Sensor data compare Failure Data 1: $B6x Data 2: $B7x	2206		0401	
Object Controller - Mixed I/O Board $B2b - Input data compare Failure	2206		0500	0000
Object Controller - Mixed I/O Board $B2b - Output data compare Failure	2206		0600	0000
Object Controller - Mixed I/O Board $B2b - Invalid state for Proximity Sensor application bits	2206		2000	0101
Object Controller - Mixed I/O Board $B2b - Invalid Board CPS Status Check	2206		FF01	0100
Object Controller - Mixed I/O Board $B2b - Output Bitstring start mismatch	2206		FF02	010?
Object Controller - Mixed I/O Board $B2b - Invalid Board CPS Status Check	2206		FF03	0100
Object Controller - Mixed I/O Board $B2b - Input Bitstring start mismatch	2206		FF04	010?
Object Controller - Mixed I/O Board $B2b - Invalid Application bit or numeric start mismatch	2206		FF05	010?
Object Controller - Mixed I/O Board $B2b - Configuration data mismatch	2206		FF06	010?
Object Controller - Mixed I/O Board Information - Data = $W2x Address = $D4x	2206			
Object Controller - Mixed I/O Board $B3b, Proximity D/A step test reading out of range	2213	10??		
Object Controller - Mixed I/O Board $B2b, Proximity Sensor failed Bypass Power Monitor Diagnostics	2213	??00		2001
Object Controller - Mixed I/O Board $B2b, Proximity Sensor failed Sensor 1 Power Monitor Diagnostics	2213	??01		2001
Object Controller - Mixed I/O Board $B2b, Proximity Sensor failed Sensor 2 Power Monitor Diagnostics	2213	??02		2001
Object Controller - Mixed I/O Board $B2b, Proximity Sensor failed 12V Monitor Diagnostics	2213	??03		2001
Object Controller - Mixed I/O Board $B2b, Proximity Sensor failed 10V Monitor Diagnostics	2213	??04		2001
Object Controller - Mixed I/O Board $B2b, Proximity Sensor failed Sensor 1's A/D Sensor Monitor Diagnostics	2213	??05		2001
Object Controller - Mixed I/O Board $B2b, Proximity Sensor failed Sensor 2's A/D Sensor Monitor Diagnostics	2213	??06		2001
Object Controller - Mixed I/O Board $B2b, Proximity Sensor failed Sensor Bypass' A/D Sensor Monitor Diagnostics	2213	??07		2001
Object Controller - Mixed I/O Board $B3b, Proximity Sensor - Bypass Power Monitor Diagnostics passed	2213	00??	0000	2002
Object Controller - Mixed I/O Board $B3b, Proximity Sensor - Sensor 1 Power Monitor Diagnostics passed	2213	00??	0001	2002
Object Controller - Mixed I/O Board $B3b, Proximity Sensor - Sensor 2 Power Monitor Diagnostics passed	2213	00??	0002	2002
Object Controller - Mixed I/O Board $B3b, Proximity Sensor - 12V Monitor Diagnostics passed	2213	00??	0003	2002
Object Controller - Mixed I/O Board $B3b, Proximity Sensor - 10V Monitor Diagnostics passed	2213	00??	0004	2002

ERROR MESSAGE†	ACTUAL ERROR CODE*			
Object Controller - Mixed I/O Board $B3b, Proximity Sensor - Sensor 1's A/D Sensor Monitor Diagnostics passed	2213	00??	0005	2002
Object Controller - Mixed I/O Board $B3b, Proximity Sensor - Sensor 2's A/D Sensor Monitor Diagnostics passed	2213	00??	0006	2002
Object Controller - Mixed I/O Board $B3b, Proximity Sensor - Sensor Bypass' A/D Sensor Monitor Diagnostics passed	2213	00??	0007	2002
Object Controller - Mixed I/O Board $B2b, Proximity Sensor Bypass Power Monitor Diagnostic passed	2213		0101	1044
Object Controller - Mixed I/O Board $B2b, Proximity Sensor A/D Monitor Diagnostic failed	2213		0101	1055
Object Controller - Mixed I/O Board $B2b, Good read for the Proximity Sensor Bypass Circuitry	2213		0101	1077
Object Controller - Mixed I/O Board $B2b, Proximity Sensor DAC step test failed - too many readings out of range	2213		1000	0601
Object Controller - Mixed I/O Board $B2b, Proximity Sensor DAC step test is valid	2213	????	1000	0602
Object Controller - Mixed I/O Board $B3b, Invalid Analog Input Threshold parameters - Min. Threshold: $W4d Max. Threshold: $W6d	2223	02??	????	????
Unknown Object Controller SCC $t - Code: $W0x $W2x $W4x $W6x	2301	????	????	????
OC_ SCC Board - Echo Error	2301	????	????	??00
OC_SCC Board $B2b - Type Error	2302	????	0020	????
OC_SCC Board $B2b - Invalid Board CPS Status Check	2306	????	FF01	0100
Unknown Object Controller IN6.OUT6 $t - Code: $W0x $W2x $W4x $W6x	2501	????	????	????
Object Controller - IN6.OUT6 Board $B6b - Echo Error $t Expected Echo: $W2x, Actual Echo: $W4x	2501	????	????	??02
Object Controller - IN6.OUT6 Board $B6b - Echo Error	2501	????	????	??22
Object Controller - IN6.OUT6 Board $B2b - Type Error	2502	????	0023	????
Object Controller - IN6.OUT6 Board $B2b, Input $B3d - Input Bad	2503	????	0000	0100
Object Controller - IN6.OUT6 Board $B2b, Input $B3d - Input Unstable	2503	????	0000	0200
Object Controller - IN6.OUT6 Board $B2b, Input $B3d - Input Good	2503	????	0000	0400
Object Controller - IN6.OUT6 Board $B2b, Input $B3d - Input Noisy	2503	????	0001	0300
Object Controller - IN6.OUT6 Board $B2b, Output $B3d - Output Flip Failure During Diagnostic Test	2504	????	0000	0100
Object Controller - IN6.OUT6 Board $B2b, Output $B3d - Output Failure During Verification	2504	????	0000	0200
Object Controller - IN6.OUT6 Board $B2b, Output $B3d - Output Noisy During Diagnostic Test	2504	????	0001	0300
Object Controller - IN6.OUT6 Board $B2b, Monitor $B3d - Output Voltage Reference ON Test Noisy	2504	????	0002	0300
Object Controller - IN6.OUT6 Board $B2b, Output $B3d - Output Noisy During Verification	2504	????	0003	0300
Object Controller - IN6.OUT6 Board $B2b, Monitor $B3d - Output Voltage Reference OFF Test Failure	2505	????	0000	0100
Object Controller - IN6.OUT6 Board $B2b, Monitor $B3d - Output Voltage Reference ON Test Failure	2505	????	0000	0200
Object Controller - IN6.OUT6 Board $B2b, Monitor $B3d - Output Voltage Reference OFF Test Noisy	2505	????	0001	0300
Object Controller - IN6.OUT6 Board $B2b - Output compare Failure	2506	????	????	04??
Object Controller - IN6.OUT6 Board $B2b - Input data compare Failure	2506	????	0500	0000
Object Controller - IN6.OUT6 Board $B2b - Output data compare Failure	2506	????	0600	0000
Object Controller - IN6.OUT6 Board $B2b - Invalid Board CPS Status Check	2506	????	FF01	0100
Object Controller - IN6.OUT6 Board $B2b - Output Bitstring start mismatch	2506	????	FF02	0100
Object Controller - IN6.OUT6 Board $B2b - Invalid Board CPS Status Check	2506	????	FF03	0100
Object Controller - IN6.OUT6 Board $B2b - Input Bitstring start mismatch	2506	????	FF04	010?
Object Controller - IN6.OUT6 Board $B2b - Configuration data mismatch	2506	????	FF06	0100

ERROR MESSAGE†	ACTUAL ERROR CODE*			
Object Controller - IN6.OUT6 Board Information - Data = $W2x Address = $D4x	2506	????	????	????
Unknown LED6 $t - Code: $W0x $W2x $W4x $W6x	26			
Object Controller - LED6 Board $B2b, Delivery Task Entry Echo $t	2601	??20	0100	
Object Controller - LED6 Board $B2b, Delivery readback $t	2601	??20	0200	0001
Object Controller - LED6 Board $B2b, Delivery readback $t, $W4x, $W6x	2601	??20		
Object Controller - LED6 Board $B2b, Verification Task Entry Echo $t	2601	??30	0100	
Object Controller - LED6 Board $B2b, Diagnostics Task Entry Echo $t	2601	??40	0100	
Object Controller - LED6 Board $B2b, Read Task Echo $t	2601	??70	01??	
Object Controller - LED6 Board $B2b, Initialization Task Type Register $t, $W6x should be 0x0024	2602	??10	0100	
Object Controller - LED6 Board $B2b, Delivery Task Type Register $t, $W6x should be 0x0024	2602	??20	0100	
Object Controller - LED6 Board $B2b, Verification Task Type Register $t, $W6x should be 0x0024	2602	??30	0100	
Object Controller - LED6 Board $B2b, Diagnostics Task Type Register $t, $W6x should be 0x0024	2602	??40	0100	
Object Controller - LED6 Board $B2b, Read Task Type Register $t, $W6x should be 0x0024	2602	??70	0100	
Object Controller - LED6 Board $B2b, Read Task Non-Vital Input is Bad	2603	??70	0001	0100
Object Controller - LED6 Board $B2b, Read Task Non-Vital Input is Unstable	2603	??70	0001	0200
Object Controller - LED6 Board $B2b, Read Task Non-Vital Input Good	2603	??70	0001	0300
Object Controller - LED6 Board $B2b, LED Signal $W6d, Undefined State Failure while in ON state and signal GOOD.	2604	??30	0101	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Undefined State Failure while in ON state and signal FAILED_ON.	2604	??30	0102	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Undefined State Failure while in ON state and signal FAILED_OFF.	2604	??30	0103	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Undefined State Failure while in ON state and signal status undefined.	2604	??30	0104	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Undefined State Failure while in OFF state and signal GOOD.	2604	??30	0105	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Undefined State Failure while in OFF state and signal FAILED_ON.	2604	??30	0106	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Undefined State Failure while in OFF state and signal FAILED_OFF.	2604	??30	0107	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Undefined State Failure while in OFF state and signal status undefined.	2604	??30	0108	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Faulted while in the ON state	2604	??30	0200	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Faulted while in the OFF state	2604	??30	0300	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Repaired while in ON state.	2604	??30	0401	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Repaired while in ON state.	2604	??30	0402	
Object Controller - LED6 Board $B2b, LED Signal $W6d, Repaired while in OFF state.	2604	??30	0501	
Object Controller - LED6 Board $B2b, Retest LEDs Activated, FAILED signals repaired to GOOD.	2605	??30	0600	0003
Object Controller - LED6 Board $B2b, DAC-ADC Start Value EOC $t, Flag = $W6x	2605	??40	0101	
Object Controller - LED6 Board $B2b, DAC-ADC Bit Step EOC $t, Flag = $W6x	2605	??40	0102	
Object Controller - LED6 Board $B2b, High Power CPS Measurement EOC $t, Flag = $W6x	2605	??40	0103	

ERROR MESSAGE†	ACTUAL ERROR CODE*			
Object Controller - LED6 Board $B2b, DAC-ADC $t, ADC1	2605	??40	0200	0001
Object Controller - LED6 Board $B2b, DAC-ADC $t ADC2	2605	??40	0300	0002
Object Controller - LED6 Board $B2b, DAC-ADC $t Retry Failure	2605	??40	0400	0000
Object Controller - LED6 Board $B2b, Shift Failure $t	2605	??40	0500	0000
Object Controller - LED6 Board $B2b, Shift Retry Failure $t	2605	??40	0500	0001
Object Controller - LED6 Board $B2b, DAC-ADC $t, ADC1 Start Value	2605	??40	1???	
Object Controller - LED6 Board $B2b, DAC-ADC $t, ADC2 Start Value	2605	??40	2???	
Object Controller - LED6 Board $B2b, DAC-ADC $t, ADC1 Step Value	2605	??40	4???	
Object Controller - LED6 Board $B2b, DAC-ADC $t, ADC2 Step Value	2605	??40	8???	
Object Controller - LED6 Board $B2b, Shift $t, $W4d occurred on Path: 1	2605	??40		1111
Object Controller - LED6 Board $B2b, Shift $t, $W4d occurred on Path: 2	2605	??40		2222
Object Controller - LED6 Board $B2b, Shift Filter Hit on Output $W4d	2605	??40		3333
Object Controller - LED6 Board $B2b, Utlity EOC $t, Flag = $W6x	2605	??60	0100	
Object Controller - LED6 Board $B2b, Utility ADC1 Signature $t, $W6x	2605	??60	0401	
Object Controller - LED6 Board $B2b, Utility ADC2 Signature $t, $W6x	2605	??60	0402	
Object Controller - LED6 Board $B2b, Non-Vital Input Set	2605	???0	0700	0003
Object Controller - LED6 IMON UnShifted data. Pre: $W2x, Post: $W4x Path: 1	2605			101?
Object Controller - LED6 VMON UnShifted data. Pre: $W2x, Post: $W4x Path: 1	2605			102?
Object Controller - LED6 IMON Shifted data. Pre: $W2x, Post: $W4x Path: 1	2605			111?
Object Controller - LED6 VMON Shifted data. Pre: $W2x, Post: $W4x Path: 1	2605			112?
Object Controller - LED6 IMON UnShifted data. Pre: $W2x, Post: $W4x Path: 2	2605			201?
Object Controller - LED6 VMON UnShifted data. Pre: $W2x, Post: $W4x Path: 2	2605			202?
Object Controller - LED6 IMON Shifted data. Pre: $W2x, Post: $W4x Path: 2	2605			211?
Object Controller - LED6 VMON Shifted data. Pre: $W2x, Post: $W4x Path: 2	2605			212?
Object Controller - LED6 Board $B2b, Startbit Mismatch $t	2606	??00	0200	000?
Object Controller - LED6 Board $B2b, Initialization Task CPS Mismatch $t	2606	??10	0100	0000
Object Controller - LED6 Board $B2b, Initialization Task Startbit Mismatch $t	2606	??10	0200	000?
Object Controller - LED6 Board $B2b, Delivery Task CPS Mismatch $t	2606	??20	0100	0001
Object Controller - LED6 Board $B2b, Delivery Task Startbit Mismatch $t	2606	??20	0200	000?
Object Controller - LED6 Board $B2b, Verification Task CPS Mismatch $t	2606	??30	0100	0002
Object Controller - LED6 Board $B2b, Verification Task Startbit Mismatch $t	2606	??30	0200	0002
Object Controller - LED6 Board $B2b, Diagnostic Task CPS Mismatch $t	2606	??40	0100	0003
Object Controller - LED6 Board $B2b, Diagnostic Task Startbit Mismatch $t	2606	??40	0200	000?
Object Controller - LED6 Board $B2b, Read Task CPS Mismatch $t	2606	???0	0100	0004
Object Controller - LED6 Board $B2b, Read Task Startbit Mismatch $t	2606	???0	0200	000?

† The following is a key to the Error Message column:

- B = byte number (0-7)
- W = word number (0, 2, 4, 6)
- D = double word or long word
- b = board name
- v = variable/bit name
- l = link name
- d = decimal value
- u = unsigned decimal value
- x = hex value

- c = ASCII character value
- $t = displays appropriate sting message (Event, Warning, Error)

* Fields and bits in the Error Code shown in the table as a "?" indicate fields/bits that that are meaningless to the error. These fields / bits have no bearing on the error and can be any value.

17. OPTIONAL PARTS LIST

The optional parts list for the OC is shown in Table 17-1.

Table 17-1. Optional Parts List

DESCRIPTION	PART NUMBER
Lightning Arrestor. Low Voltage (Blue), Primary lightning protection for input and outputs.	N4515520101
Lightning Arrester, High Voltage (Red), Primary lighting protection for inputs and outputs	N4515520201
Proximity Sensor*, 5 mm sensing distance	J7381040009
Proximity Sensor*, 10 mm sensing distance	J7381040031
Proximity Sensor*, 10 mm sensing distance with detachable cable.	J7381040033
Proximity Sensor*, 15 mm sensing distance	J7381040032
Proximity Sensor*, 20 mm sensing distance	J7381040030
Proximity Sensor*, 20 mm sensing distance with detachable cable	J7381040029
MOV 24 Volt, Part Number V24ZA50. Connect across each proximity sensor.	J7355500016
WAGO insertion tool, Part Number 210-120. Used to insert and remove wires from connectors.	J0390000159
Connector –16-pole - gray (for I/O)	J7091461908
Connector –16-pole - orange (for I/O)	J7091461909
Connector – 4-pole - orange (for power input)	J7091461910
Connector – 12 pole – orange (LED6)	J7091462070
CPS power fuse next to connector J1 – 15A Slow-Blow	J7100380025
System power fuse next to ON/OFF switch – 10A Fast Acting	J7100380027
ASTS USA Constant Current Regulator Module	N34801301
ASTS USA ARR Protection Board (House wiring on left side)	N46205201
ASTS USA ARR Protection Board (House wiring on right side)	N46205202
ASTS USA LED Signal Protection Board (part of signal assembly)	N46205001
ASTS USA LED Signal Assembly - Red (6 3/8")	N46204401
ASTS USA LED Signal Assembly – Green (cyan) (6 3/8")	N46204402
ASTS USA LED Signal Assembly – Yellow (amber) (6 3/8")	N46204403
ASTS USA LED Signal Assembly – Lunar (white) (6 3/8")	N46204404
Dongle**	N18400801
Write-Enable Adapter**	N16929801

* For use with Object Controller Part Numbers N17700101, N17700102, and N17700103 only.

** For use with Object Controller Part Number N17700119 only.

18. TECHNICAL SUPPORT

The Rapid Action Information Link Team (RAIL Team) is a group of experienced product and application engineers ready to assist you to resolve any technical issues concerning this product. Contact the RAIL Team in the United States at 1-800-652-7276 or by e-mail at railteam@ansaldo-sts.us.

End of Manual